TECHNOLOGY DEPT.

the OIL AND GAS JOURNAL

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DETROIT

Here's why HUGHES OSC series bits get more hole quicker in soft formations

The Hughes OSC rock-bit series is particularly designed for formations of low compressive strength in which soft, plastic, adhesive materials are frequently encountered. Such materials cannot be removed efficiently by chipping alone. You need a tooth action that will penetrate, move the formation and tear it loose.

This tooth action can be demonstrated with a knife and modeling clay. If you stick a knife blade into the clay, and then pull it out, you don't remove any material. The best way to remove a piece of the clay is to push the blade in, twist and scoop out. This is the principle on which the Hughes OSC series of rock bits is designed.

The twisting, tearing action of the long, coarse-pitched teeth enables the bit to scoop the formation in this manner without balling up. The intermeshing feature of the Hughes Tri-Cone bit, plus the scientifically directed jetting action, assures the most efficient cleaning. That's why, on rig after rig, you'll find Hughes OSC series bits in the hole!

HUGHES OSC SERIES TRI-CONE ROCK BITS

World Standard of the Industry

HUGHES
TOOL COMPANY
HOUSTON, TEXAS

PRICE 50 CENTS TABLE OF CONTENTS PAGE 85 AUGUST 24, 1950

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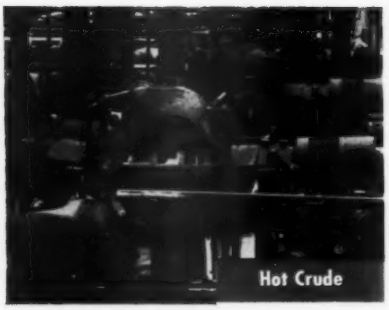
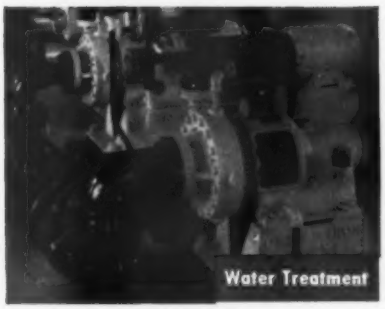
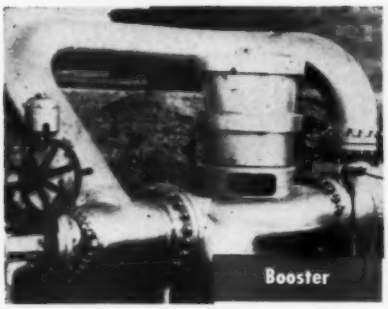
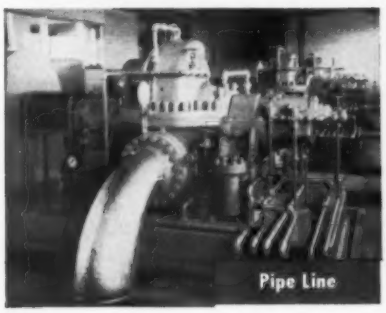
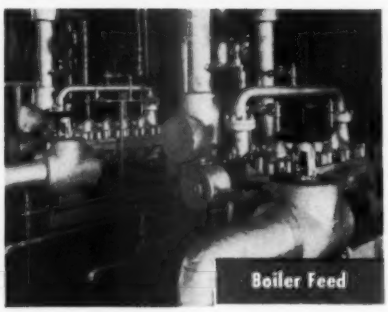










UNITED CENTRIFUGAL PUMPS } Engineered to each job for *Plus Performance*

United's unique engineering and manufacturing facilities are set up to tailor each pump to meet specific job requirements. This means custom-built performance without premium cost. *Yet basic United designs provide for maximum interchangeability of parts, easy accessibility, simplified maintenance.* Thousands of installations, from refineries to pipelines, are daily proving the dependability and efficiency of United Centrifugal Pumps . . . backed by over a quarter-century of specialized service to the oil industries. Make it a point to submit *your* pumping problems to United engineers, for only an engineered-to-the-job pump can assure you top performance—year after year. Contact your nearest United sales office today.

UNITED CENTRIFUGAL PUMPS — Division of United Iron Works — Since 1880

Main Offices and Plants: **Oakland 7, California**

Sales Offices: LOS ANGELES • HOUSTON • DENVER • TULSA • ST. LOUIS • CHICAGO • CLEVELAND • NEW YORK

Du Pont Announces

"ORTHOLEUM" 300 GREASE STABILIZER

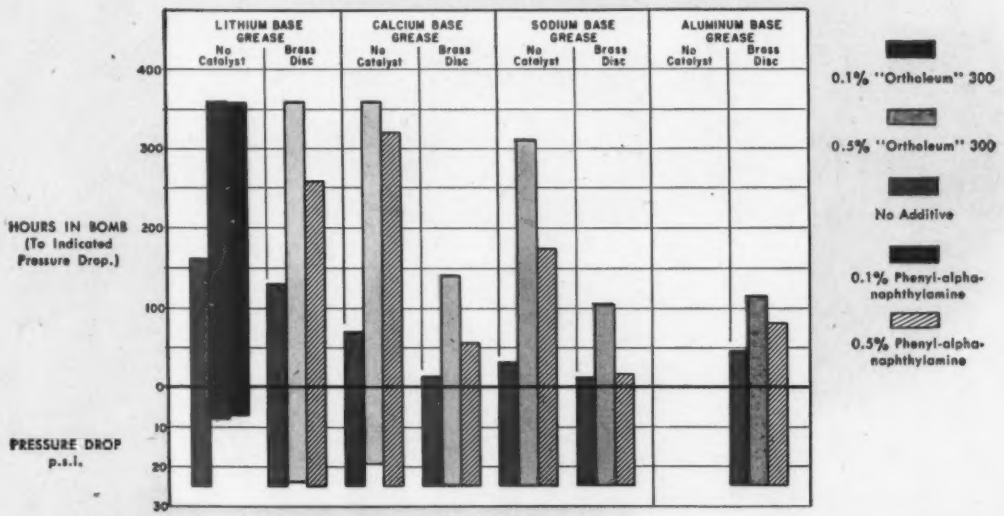
SEND FOR SAMPLES . . . to evaluate in your own greases. Write the nearest District Office or ask your Petroleum Chemicals representative for samples. Also, for more complete information ask for Technical Bulletin GS-50.

To help meet the demand for greases of higher stability to stand up under the higher temperatures and loads of many present-day grease applications, Du Pont has developed "Ortholeum" 300 Grease Stabilizer. This new additive combines both antioxidant and metal deactivating properties. The combination imparts oxidation stability to the grease superior to that attainable with antioxidants alone and in addition does not cause discoloration of the finished product.

The effectiveness of "Ortholeum" 300 has been evaluated in many types of greases and laboratory tests show marked superiority over compounds such as Phenyl-alpha-naphthylamine. This is indicated in the chart below which gives results of Norma-Hoffman Oxidation Tests on several greases.

"Ortholeum" 300 is easily added to the grease during manufacture and cost of using it is very low. For the normal concentrations, treating cost runs only around .4c/lb.

NORMA-HOFFMANN OXIDATION TEST



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Better Things for Better Living
. . . through Chemistry

Petroleum Chemicals

Make Du Pont the Source for All of Your Gasoline Additives . . . Tetraethyl Lead Compounds (Motor Mix—Aviation Mix)—Antioxidants—Metal Deactivator—Dyes

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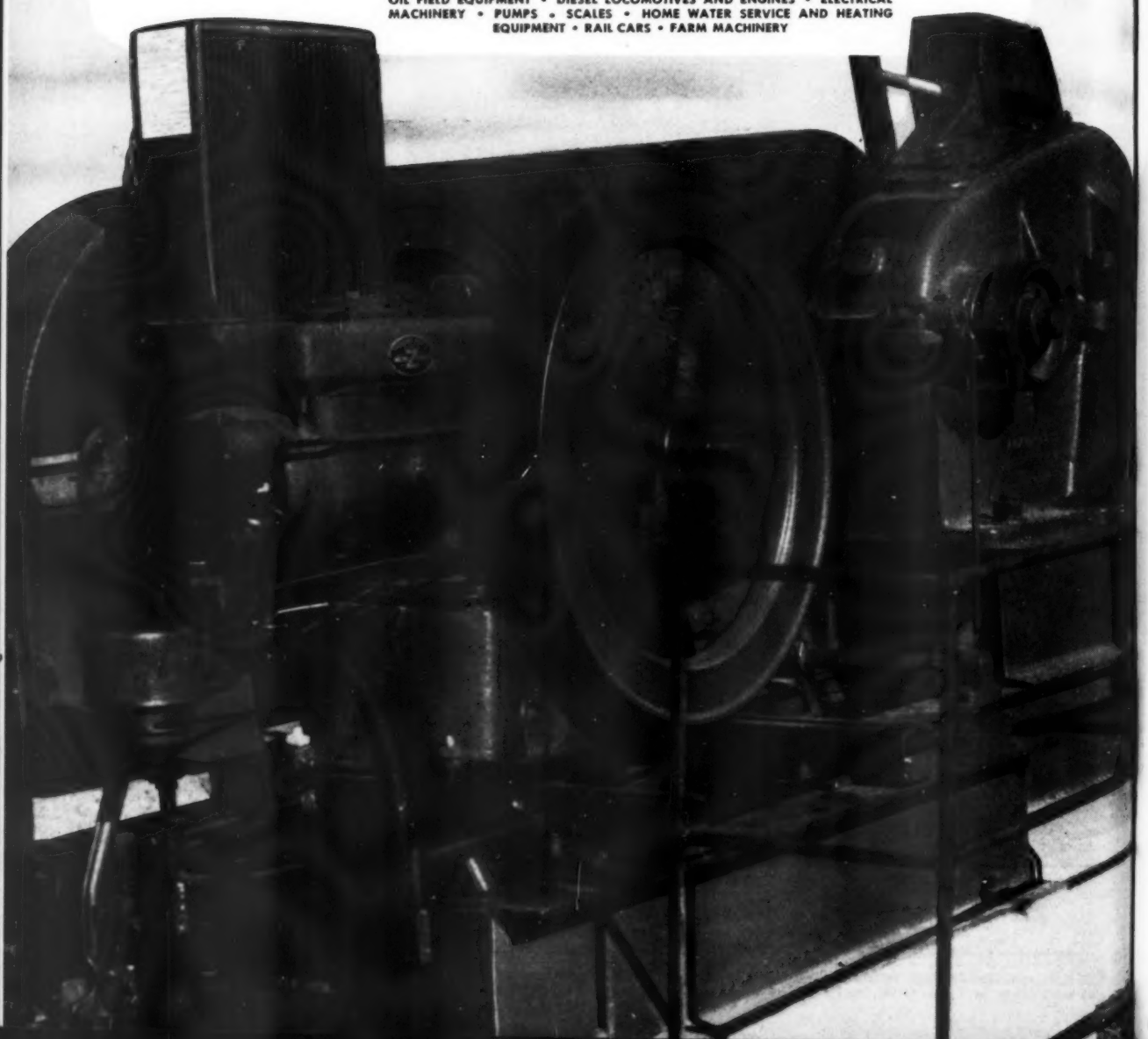
THEY DON'T GET "Burned-up"

You don't have to worry about "burning up" a Fairbanks-Morse "ZC" Engine by overloading it. The automatic intake valve automatically limits the amount of horsepower the engine can deliver. The admission of the air and gas mixture is restricted beyond a predetermined point. This feature, plus the extra heavy flywheels, prevents the engine from being intermittently overloaded or underloaded. It's impossible to burn up the engine in a short time by accidentally overloading it. This is just one of the many features that keep a "ZC" running long after the ordinary engine has worn out . . . why many "ZC's" are still in service after more than two decades of service. Check them at your supply store. Fairbanks, Morse & Co., Chicago 5, Ill.

FAIRBANKS-MORSE,

a name worth remembering

OIL FIELD EQUIPMENT • DIESEL LOCOMOTIVES AND ENGINES • ELECTRICAL MACHINERY • PUMPS • SCALES • HOME WATER SERVICE AND HEATING EQUIPMENT • RAIL CARS • FARM MACHINERY



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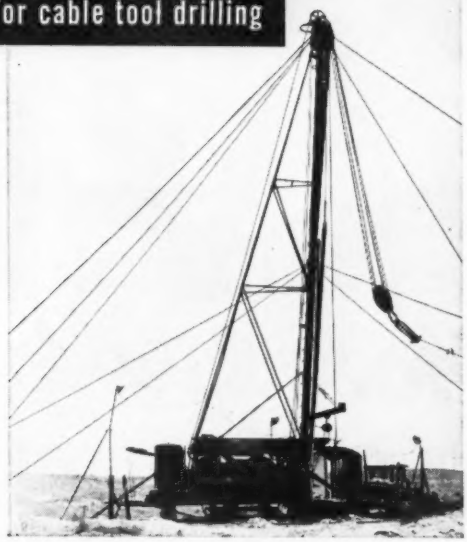
There's a Macwhyte rope that's the right rope . . .

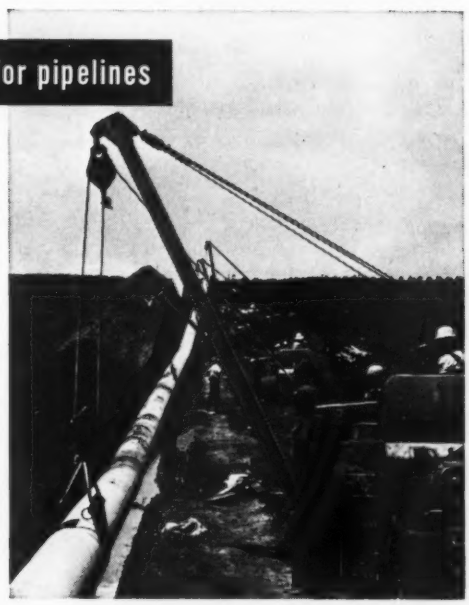
For rotary drilling

For cable tool drilling



For well servicing

For pipelines



A thousand and one
WIRE ROPES
made by
MACWHYTE,
all job-proved . . .

Because your equipment is designed specially for the work you are doing, you'll get the best service by using wire rope *specially designed* for your equipment.

From the thousand and one wire ropes made by Macwhyte, you're sure to get the wire line specially designed for and suited to your needs.

The specialized experience of Macwhyte engineers is yours for the asking—to get recommendations for all your needs, just call a Macwhyte distributor or write Macwhyte Company.

MACWHYTE COMPANY, 2916 Fourteenth Avenue, Kenosha, Wisconsin. Manufacturers of Monarch Whyte Strand PREformed, Internally Lubricated Wire Rope, Atlas Braided Wire Rope Slings, Aircraft Cables and Assemblies, Monel Metal and Stainless Steel Wire Rope. Mill Depots: New York • Pittsburgh • Chicago • Minneapolis • Fort Worth • Portland • Seattle • San Francisco • Los Angeles. Catalog on request.

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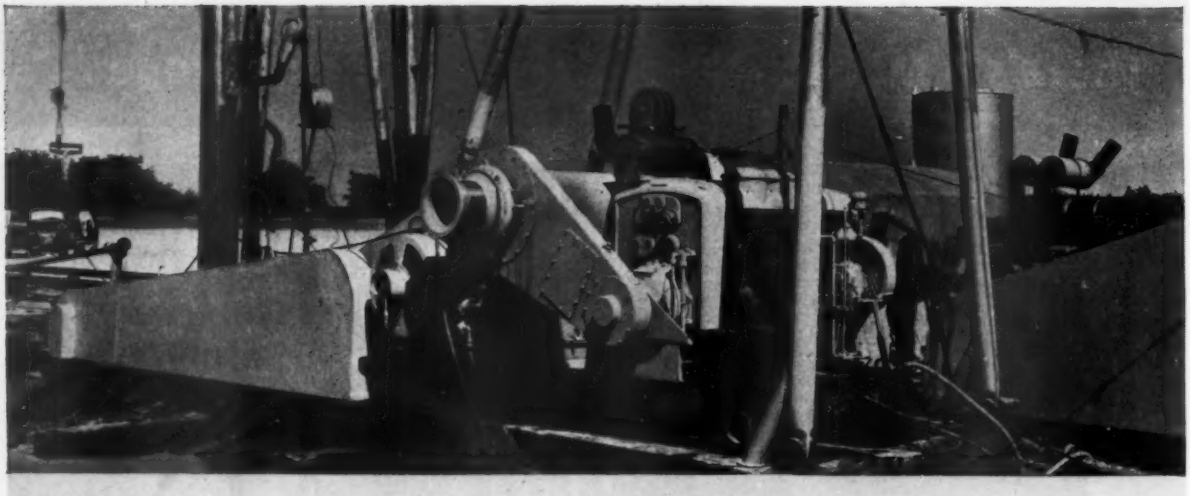


More Work-Faster

with GM DIESEL TORQUE CONVERTER UNIT

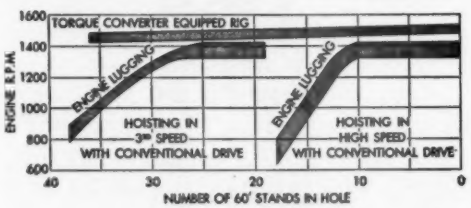
ASK any drilling contractor who has powered his rig with a General Motors Diesel engine-torque converter what he likes most about it. He'll probably mention three things.

First, more power in less space. Second, faster acceleration that saves valuable time. And third, important fuel savings.

All this is possible because this compact, integrated unit combines the inherent efficiency of the Series 71 GM 2-cycle Diesel engine with the best operating characteristics of *both* torque converter and fluid coupling.

Engine lugging is eliminated because, as the diagram shows, the GM Diesel engine-torque converter unit always operates in its most effective speed range—*automatically* selects the most favorable ratio between engine speed and load speed. It gives maximum *speed* for raising empty block and maximum *pull* for coming out—instantly—without throttling the engine, declutching or changing gears. This means easier, smoother operation and a lot less wear and tear on equipment. It means more work done—faster.

ENGINE-LUGGING CHARACTERISTICS OF DRAW WORKS EQUIPPED WITH TORQUE CONVERTER DRIVE AS COMPARED WITH CONVENTIONAL DRIVE



If you are considering a new drilling rig or new power for old equipment, be sure to see our catalog, *"NEW General Motors Diesel-Engine Torque Converter Unit."* We'll gladly send you a copy.

SEE OUR CATALOG IN THE COMPOSITE CATALOG

DETROIT DIESEL ENGINE DIVISION

SINGLE ENGINES... Up to 275 H.P. **DETROIT 28, MICHIGAN** MULTIPLE UNITS... Up to 800 H.P.

GENERAL MOTORS

GM GENERAL MOTORS DIESEL POWER

DIESEL BRAWN WITHOUT THE BULK

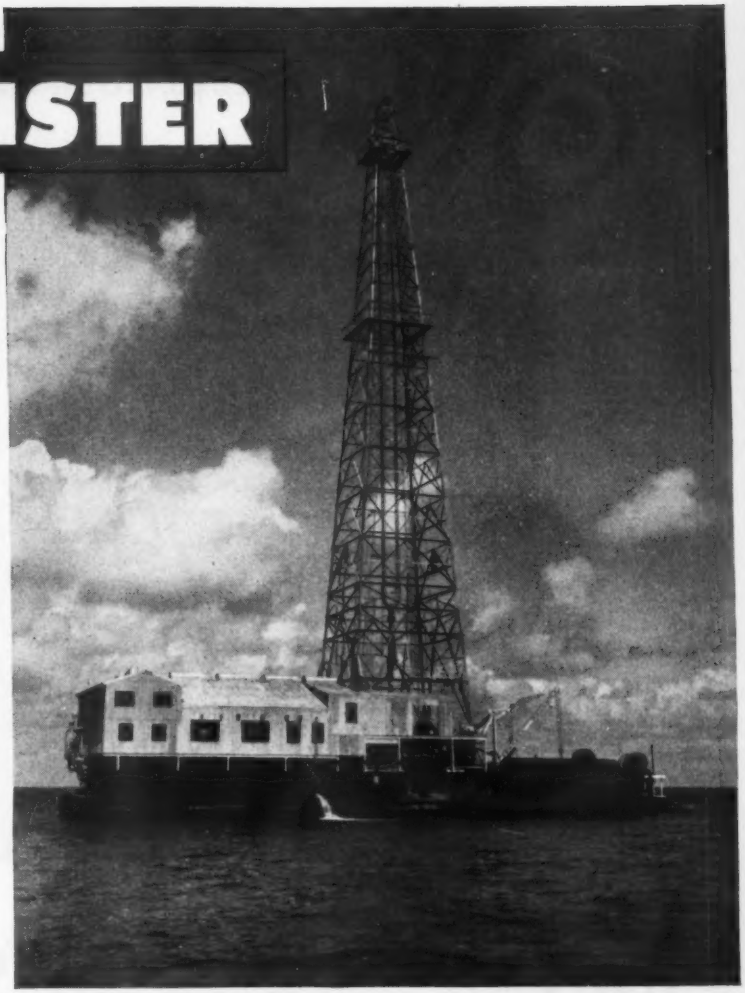
GENERAL MOTORS CORP., DIESEL ENGINE SALES, PETROLEUM INDUSTRY, 1504 Philtower Bldg., TULSA 3, OKLAHOMA

CALIFORNIA: Anderson-O'Brien Co., LOS ANGELES 21; Lawless Brothers, BAKERSFIELD; West Coast Engine & Equipt. Co., BERKELEY. **ILLINOIS:** Western Machinery & Engine Co., CENTRALIA. **KANSAS:** Diesel Equipment Co., Inc., WICHITA. **COLORADO:** Colorado Builders' Supply Co. (Equipt. Division), DENVER. **LOUISIANA:** George Engine Co., Inc., HARVEY; United Tool & Valve Repair Co., SHREVEPORT. **MISSOURI:** Western Machinery & Engine Co., ST. LOUIS 10. **MONTANA:** Seitz Machinery Co., Inc., BILLINGS; Mountain Tractor Co., MISSOULA. **OKLAHOMA:** Diesel Power Co., OKLAHOMA CITY. **TEXAS:** Stewart & Stevenson Services, Inc., HOUSTON 1, McALLEN, DALLAS, CORPUS CHRISTI, WICHITA FALLS; Haynes Machinery Co., PLAINVIEW; Empire Machinery Co., Ltd., ODESSA. **WYOMING:** Colorado Builders' Supply Co. (Equipt. Division), CASPER.

MISSISSIPPI: Taylor Machine Works, Jackson

SEA MONSTER

LINK-BELT *Precision Steel* ROLLER CHAIN KEEPS THIS GIANT ON THE JOB



Down in the gulf, where this largest power rig afloat works, shut downs are costly. Link-Belt chains are manufactured so they pay off in service.

Modern oil well drilling practice frequently subjects chains to momentarily high loading which requires chains of high fatigue strength. Link-Belt multiple-width precision steel roller chains for oil country application are given high fatigue strength characteristics to meet these conditions.

Carried in stock at Indianapolis, Houston, Dallas, Los Angeles and at your local supply store.

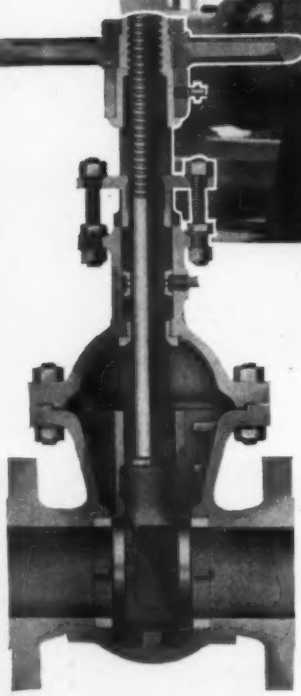
LINK-BELT COMPANY

11,057

Indianapolis 6, Dallas 1, Houston 1, Kansas City 8, Mo., Los Angeles 33, New York 7, Toronto 8.
Offices in Principal Cities.

DARLING VALVES

FOR PLUS VALUES, JOB-PROVED AGAIN AND AGAIN



Cutaway view of Darling cast steel gate valve shows complete simplicity of the fully revolving, double disc, parallel seat principle . . . just four simple working parts . . . two interchangeable, no-pocket discs and two husky wedges. Maintenance is minimized and extremely easy . . . assembly foolproof. And as to all-around behavior . . . it's a perfect natural for pipe line service! Darling pipe line gate valves have full seat opening, same as I.D. of pipe, allowing free passage of line scrapers.

HOW DARLINGS CUT COSTS ...*"All along the line"*

THE cutaway view shows a gate valve feature that saves no end of dollars and maintenance time in all kinds of pipe line service. It's the *Darling fully revolving, double disc, parallel seat principle* . . . a money-saver, for example, in the 20" power-operated cast steel gate valves in the pipe line manifold installation pictured here.

On line after line this unique Darling feature proves its time-and-money-saving value because it cinches such important advantages as . . .

1. Positive, easy, tight closing.
2. Automatic adjustment for valve body distortion.
3. Elimination of disc-to-seat galling.
4. Uniform wear distribution.
5. Greater service life with less maintenance.

SEND FOR DATA

If you don't have *all* the facts on Darling gate valves of this type, it will pay you to look into them. Darling parallel seat gate valves come in a wide range of sizes and constructions for *all* gas and oil line requirements. Simply outline your particular service needs or ask for complete descriptive bulletin.

DARLING VALVE & MANUFACTURING CO.

Williamsport 1, Pa.

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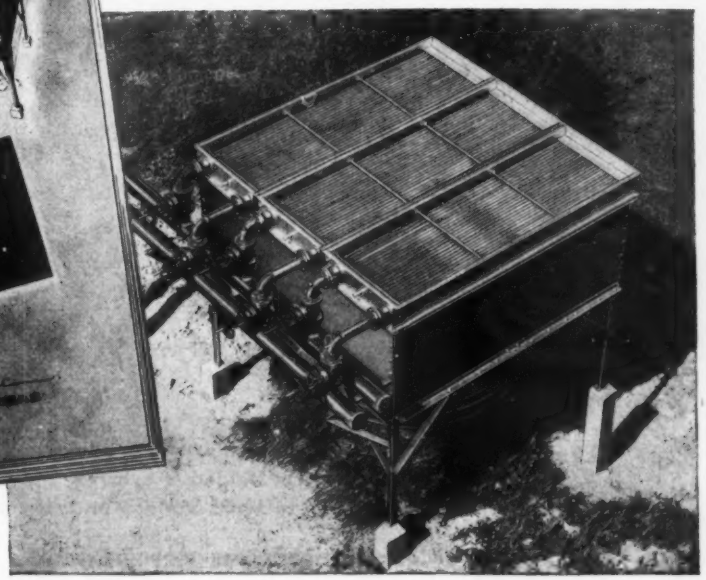
RATINGS & DATA ....YOU'LL WANT



on dry cooling equipment... DriCooler®

Whether you have an engine in a power plant — products to cool or condense in a natural gasoline plant — engines or gas to cool at a gas pipeline compressor station — high level heat dissipation in a refinery or a small standby engine to cool .... Marley has a DRICOOLER to do your job!

Small "packaged" DRICOOLERS or large industrial units are all built to give years of dependable service. All DRICOOLERS, large or small, have finned tubes that are easy to clean, quick to drain and have been tested for long life. Proven Marley mechanical equipment insures smooth, quiet operation.

DRICOOLERS are standard in forced or induced draft, horizontal or vertical coils, steel units or abestos-board covered redwood structures, and sections are available with various fin and tube materials and header arrangements.

WRITE FOR THE NEW DRICOOLER BULLETIN

- Gives rating tables for cooling water
- Lists dimensions and weights
- Shows coils, structure and mechanical equipment
- Photographs of actual installations

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Please send me without obligation Bulletin DC-50 on the complete line of Marley DRICOOLERS.

Name_____ Title_____

Company Name_____

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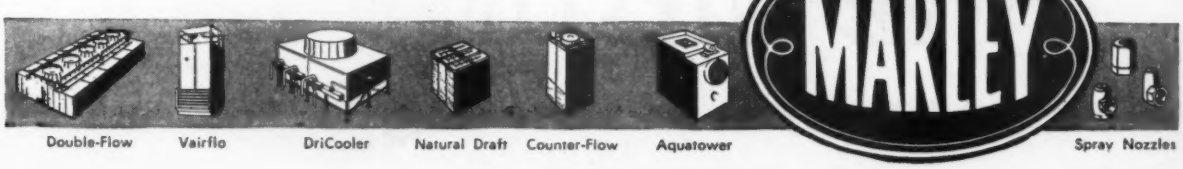
City_____ State_____



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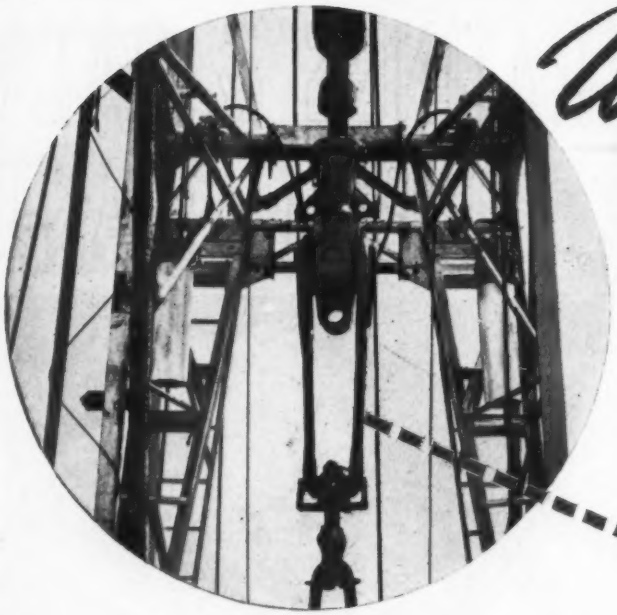
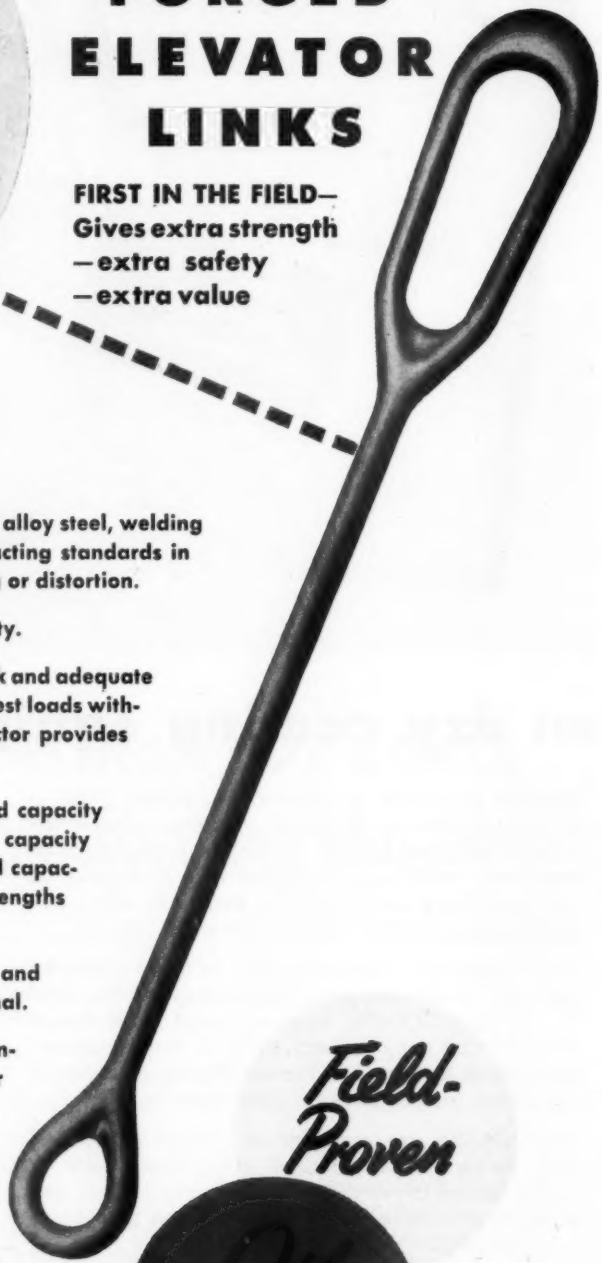


Web Wilson

FORGED ELEVATOR LINKS

FIRST IN THE FIELD—
Gives extra strength
—extra safety
—extra value



- Forged from a single billet of tough, strong alloy steel, welding is entirely eliminated. Heat treated to exacting standards in modern vertical furnaces to avoid warping or distortion.
- Magnafluxed to assure perfection of quality.
- Carefully designed with full diameter shank and adequate steel at points of stress—will take the heaviest loads without flexure or distortion—4 to 1 safety factor provides extra safety and longer service life.
- Made in three sizes—1¾" diameter, rated capacity of 65 tons per link—2¼" diameter, rated capacity of 110 tons per link—2¾" diameter, rated capacity of 150 tons per link—furnished in lengths ranging from 36" to 108".
- Available with bent or straight upper and lower eyes—wire line handles are optional.
- For maximum drilling efficiency and economy, specify Web Wilson Forged Elevator Links—first developed by Web Wilson to meet the requirements of heavy service and severe usage.

Field-Proven

WEB WILSON

Oil Tools

HUNTINGTON PARK, CALIF. • HOUSTON, TEXAS • NEW YORK CITY

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- Sizes ½ to 6⅝ inches O.D.
- Wall Thickness .083 to 1.000 inches.
- Analyses—To Meet Conditions Where Heat, Corrosion, Pressure and Structural Strength are Involved.

Do the job best with the best tubing for the job — get

GLOBE

ALLOY STEEL TUBES

SEAMLESS—MECHANICAL—PRESSURE

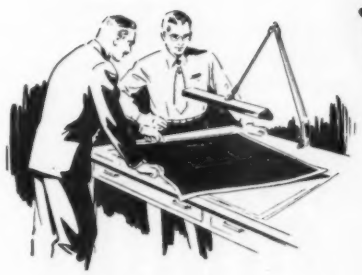
TYPICAL ANALYSES:

Carbon Moly
1¼% Chrome ½% Moly .50/1.00
1¾% Chrome .60/.80 Moly
2% Chrome ½% Moly
2¼% Chrome .90/1.00% Moly
4/6% Chrome ½% Moly
6-8% Chrome ½% Moly
7-9% Chrome ½% Moly
SAE 1335
SAE 2300
SAE 2512
SAE 4130; SAE 4140
SAE 4615
SAE 8615, 8617 Fine Grain
SAE 8620; 8630; 8635; 8640
5% Ni.
9% Ni.

TYPICAL APPLICATIONS:

Superheat Tubes
Pressure Tubes
Still Tubes
Mechanical Tubes
Condenser Tubes
Barrel Tubes
Pump Barrels — Oil Well
Evaporator Tubes
Aircraft Tubes
Propellers
Rollers for Transmission Chains
Oil Well Tubing

GLOBE TUBES



Globe engineers gladly give you the benefit of specialized knowledge and experience on the application of steel tubing in a wide range of services — mechanical — pressure — corrosion resistant.

GLOBE STEEL TUBES CO., Milwaukee 4, Wis.

Chicago - Minneapolis - Cleveland - Detroit - New York - Philadelphia St. Louis - Tulsa - Houston - Denver - San Francisco - Glendale, Calif.

Producers of Globe Seamless Stainless Steel Tubes — Gloweld Welded Stainless Steel Tubes — Carbon-Alloy-Seamless Steel Tubes — Globeiron Seamless High Purity Ingot Iron Tubes — Globe Welding Fittings.

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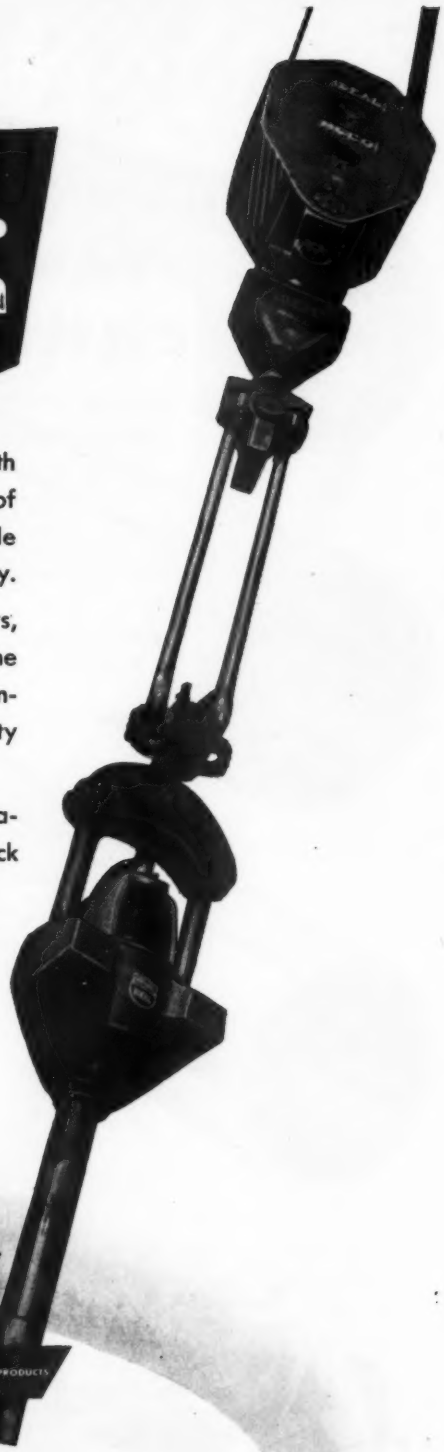
ANY LOAD... to any depth

Any load from 60 to 630 tons . . . to any depth from shallow to deepest . . . there's a set of matched "Ideal" Derrick Equipment to handle that load to that depth dependably, safely.

Crown blocks, traveling blocks, connectors, swivels . . . all carry the name "Ideal", and the famous "National Blue" color. All are conservatively rated to provide ample safety factor and less wear.

Ask the National Supply store or representative for bulletins describing "Ideal" Derrick Equipment to meet your lifting needs.



THE NATIONAL SUPPLY COMPANY

GENERAL SALES OFFICES: TOLEDO, OHIO

NATIONAL BLUE PRODUCTS

DIVISION OFFICES: CASPER; FT. WORTH; PITTSBURGH; TULSA; TORRANCE.

CANADA: THE NATIONAL SUPPLY COMPANY, LIMITED, ROOM 202, ALBERTA BLOCK, CALGARY, ALBERTA.

EXPORT: NATIONAL SUPPLY EXPORT CORPORATION, 30 ROCKEFELLER PLAZA, NEW YORK, N. Y., U. S. A.; RIVER PLATE HOUSE, 12 SOUTH PLACE, LONDON E. C. 2.

NATIONAL OIL FIELD MACHINERY AND EQUIPMENT . . . SPANG PIPE . . . SUPERIOR ENGINES

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Little Landis
PIPE THREADING & CUTTING MACHINE

FOR
Maintenance
AND
Jobbing

● The LITTLE LANDIS Pipe Threading and Cutting Machine is designed for threading bolts and for cutting off and threading pipe in jobbing and maintenance shops. In the illustrations on this page, the 2" LITTLE LANDIS is producing bolt threads for use in maintenance work.

The LITTLE LANDIS can handle a variety of work at a minimum cost, permit the quickest possible set-up changes, and produce cleanly-cut and well-formed threads on all materials. It uses the Landis Chaser, the only pipe threading die with the same free-cutting action and natural clearance of a lathe tool. This allows for long life between chaser grindings and smooth finish and accuracy in the finished thread.

Write for Bulletin C-82

LANDIS MACHINE CO.
WAYNESBORO, PA., U.S.A.

LANDIS TRADE-MARK

Represented in the Domestic Oil Fields by: Colcord-Wright Machinery & Supply Co., St. Louis, Mo.; C. J. Harter Machinery, Houston, Texas; Frederic-Baker Co., New Orleans, La.; Moore Machinery Co., Los Angeles and San Francisco, Calif.; Hendrie & Bolthoff Mfg. & Supply Co., Denver, Colo.

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BIG NEW TEAM for LAYING BIG PIPE

"CATERPILLAR" OFFSET D8 TRACTOR WITH TRACKSON PIPELAYER

LOWERS THE BOOM ON CONSTRUCTION COSTS!

Big pipe goes down fast and easy when you handle it with this *big outfit,* especially designed to provide tremendous lifting capacity and accurate spotting control. That's why Bechtel, Price, Conyes Corp., Needles, Calif., chose it for laying this 34" high-pressure gas line, the largest in the world. Working the stretch from Topock, Arizona, to Milpitas, Calif., the new "Caterpillar" Offset D8 Tractor with new Trackson Pipelayer averages 9000 feet per 10-hour day. The pipe is 7/16" thick and weighs 192 lbs. per ft. In all, there are 23 "Caterpillar" Diesel Tractors on the operation—and they're paying off with schedule-keeping performance.

Got a big job to figure? You can count on this *big outfit* to make good for you. Rugged and reliable, it's the answer to your problem of handling big pipe profitably. Get the facts today about the Offset D8 from your nearby "Caterpillar" dealer.

CATERPILLAR TRACTOR CO., PEORIA, ILLINOIS

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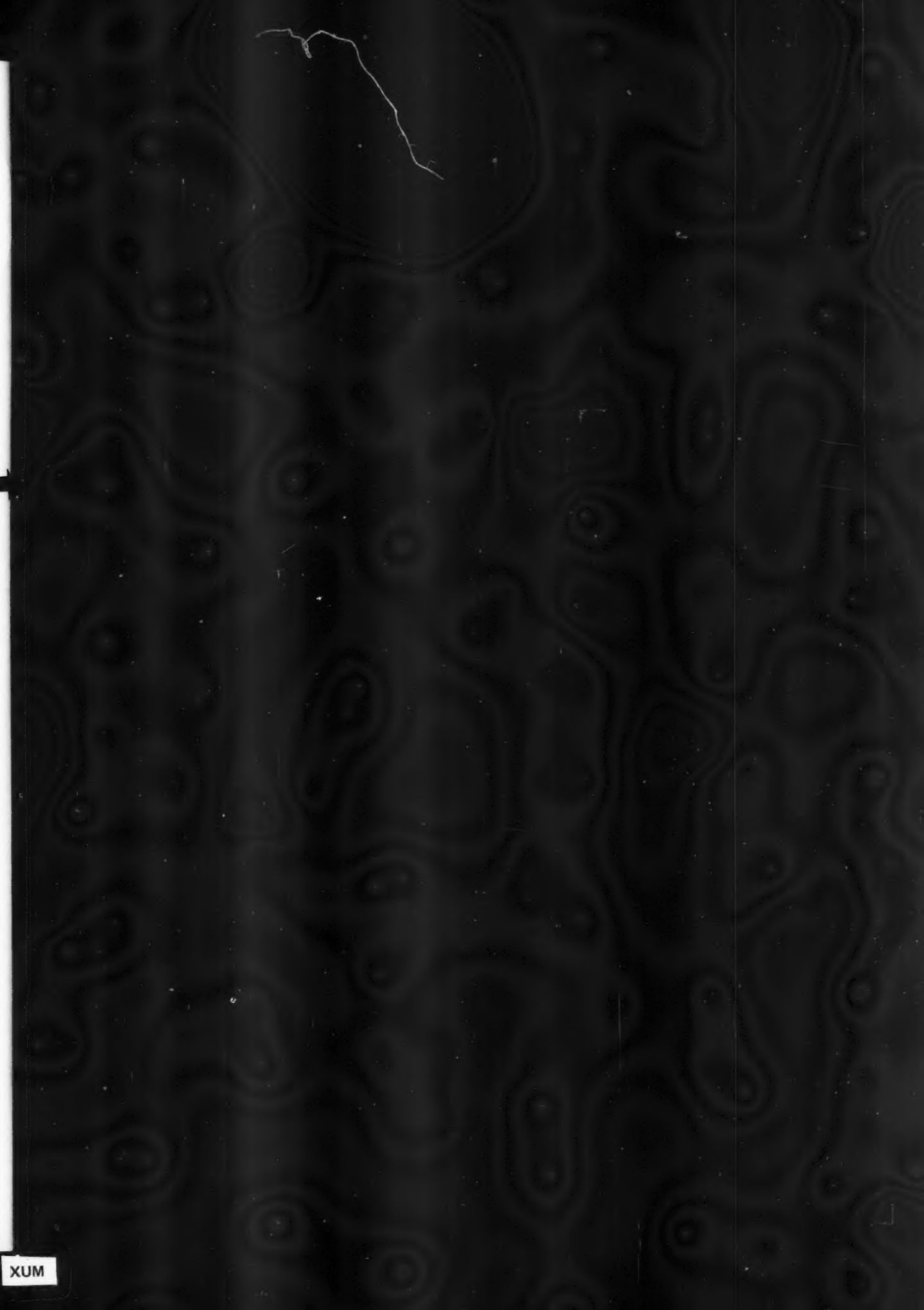
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C
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Check the Advantages OF THE "Caterpillar" Offset D8 Tractor

1. ***Extended track frame*** on the trench side provides maximum leverage.
2. ***Extra-wide shoes*** on the trench side reduce ground pressures and track penetration. This improves performance when "walking" pipe in soft terrain and reduces chances of cave-in.
3. ***Hydraulically controlled counterweight (10,000 lbs.)*** gives the balance needed for handling big pipe. When working tight places, it can be quickly retracted.
4. ***Greater lifting capacity,*** for example:

Overhang	*4'*	*6'*	*8'*	*10'*	*12'*	*15'*	*18'*
Capacity, lbs.	83,600	55,500	41,500	33,000	27,400	21,800	18,000

5. ***Proper boom and hook speeds*** provide better control, facilitate accurate spotting of heavy pipe. The Offset D8 also has improved, increased-capacity drum braking for instant control.

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REG U.S. PAT. OFF

DIESEL ENGINES • TRACTORS • MOTOR GRADERS • EARTHMOVING EQUIPMENT

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you can't beat this

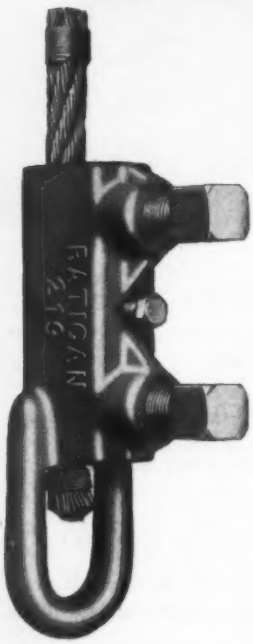
Ratigan Pumping

combination!

GREATER EFFICIENCY

GREATER DEPENDABILITY

GREATER SAFETY



RATIGAN NO. 204 POLISH ROD GRIP has 53,000 pounds capacity, yet weighs only 19 pounds. It is designed for all present type unitized pumping equipment, which require a short, narrow gripping device of high capacity. It will accommodate 1⅛" & 1¼" polish rods and all sizes of sucker rods. Sizes for 1½" polish rods also available. A comparison of the No. 204 with two of our former major screw type grips is given in the table below:

Type	Approx. Holding Capacity	Approx. Weight	Price
No. 7 2 Screw	37,000 lbs.	30 lbs.	$25.00
No. 50 2 Screw	53,000 lbs.	45 lbs.	35.00
No. 204 2 screw	53,000 lbs.	19 lbs.	25.00

RATIGAN NO. 220 SHOCK ABSORBER . . . a combination carrier bar and shock absorber used with horseheads that have from 7" to 9" centers. When in operation and the weight of the sucker rods is on the rubber, the rubber will automatically center itself and expand through the 12 chamfered holes of the body, thus cushioning the impact of the well on the reversal of the stroke. It greatly reduces the breakage of sucker rods and polish rods, and is very beneficial to motors, engines and gears. For horseheads that have 12" to 14" centers, use the Ratigan No. 111 Shock Absorber.

RATIGAN NO. 219 WIRE LINE CLAMP . . . our latest wire line clamp. It can be used on the deepest wells and is an outstanding improvement over babbitting the lines into the carrier bar or babbitt sockets. It will take any size wire line from ¾" to 1¼" inclusive and is designed for any trunnion type carrier bars used in connection with bridles on pumping wells. Used in pairs only . . . 80,000 pounds capacity per pair.

For complete information regarding the "Ratigan Pumping Combination", write, wire or telephone:

J. P. RATIGAN, Inc.

1213 Santa Fe Avenue, Los Angeles 21, California
Export: National Supply Export Corporation,
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RATIGAN PRODUCTS ARE SOLD THROUGH LEADING SUPPLY STORES

O'HARA LIMESTONE
IN
CANEY MOUND EAST FIELD
UNION COUNTY, KENTUCKY

18

Mud (Aquagel): R_m 2.0 at BHT
Bit Size: 8¾"
Spacings: AM = 16"
AM' = 55"

LOG ANALYSIS

1) Water saturation S

R_w = 0.065 ohm—samples from adjacent wells
F = 35—laboratory analysis from cores in adjacent wells
$R_o = FR_w = (35)(0.065) = 2.3$ ohms
R_t = 125 ohms

$$S = \sqrt{\frac{2.3}{125}} = 13.6\%$$

2) Porosity p

$$p = \sqrt[m]{\frac{1}{F}} = 17\% \text{ for } m = 2$$

"MICROLOG"—indicates good permeability from 2516' to 2535'

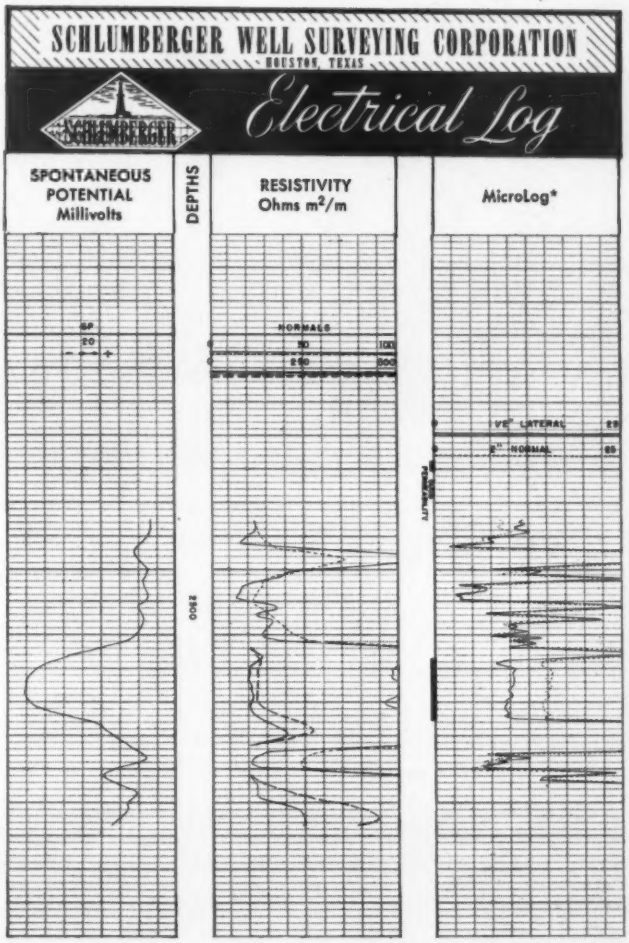
CORE ANALYSIS

Average Porosity 17.4%
Average Water Saturation 20%

PRODUCTION RESULTS

Perforated: 2512' - 2535'
Potential: 2955 bbl/day after acidizing

*"MicroLog" is a trade mark of the Schlumberger Well Surveying Corp.



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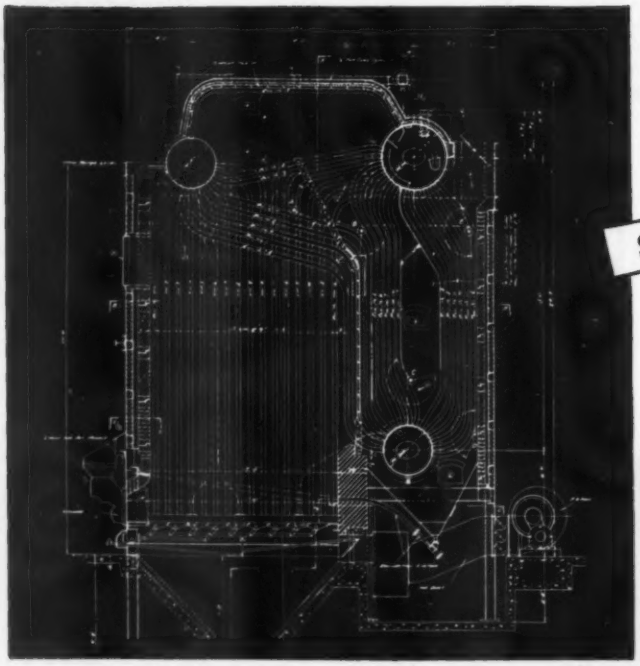
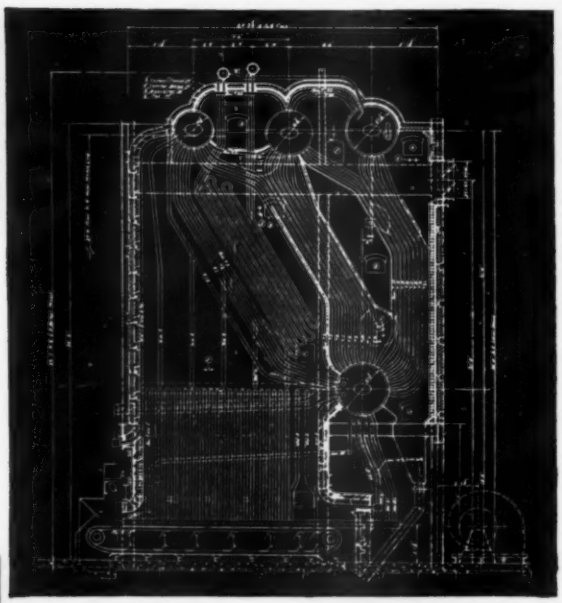


Carry high overloads with high efficiency

SPECIFY Vogt

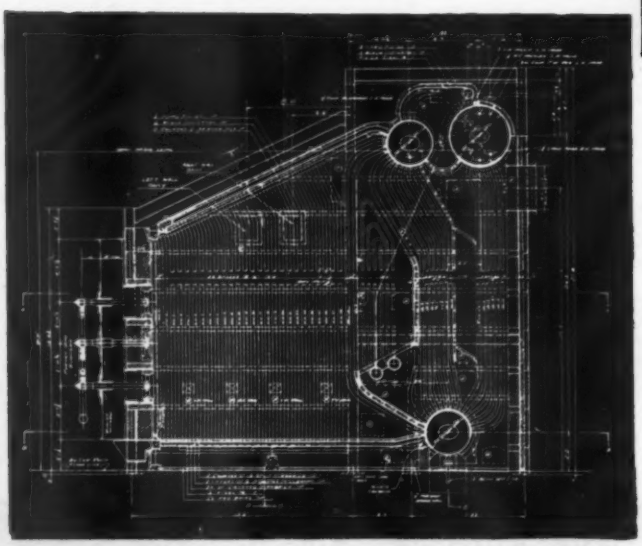
STEAM GENERATING UNITS



CLASS VL Two 27,500 pounds per hour units, installed at Brown-Forman Distillers Corporation, Louisville, Ky. Features large furnace volume in limited space, with high ratio of radiant heating surface.

CLASS LE Mt. Carmel Public Utility, Mt. Carmel, Illinois, is served by this 60,000 pounds per hour unit. Generous steam liberating surfaces and steam space permit wide fluctuations in load.

CLASS VR 70,000 pounds per hour steam generator at Humble Oil and Refining Company, Johnsue, Texas. An efficient, high-duty unit with water cooled furnace, using refinery gas fuel.



Vogt builds a complete line of bent tube steam generators, designed to burn solid, liquid, or gaseous fuels to meet specific operating conditions. Superheaters, air preheaters, economizers, water walls, and soot blowers can be readily incorporated. Bulletins with general information and showing typical installations are available upon request.

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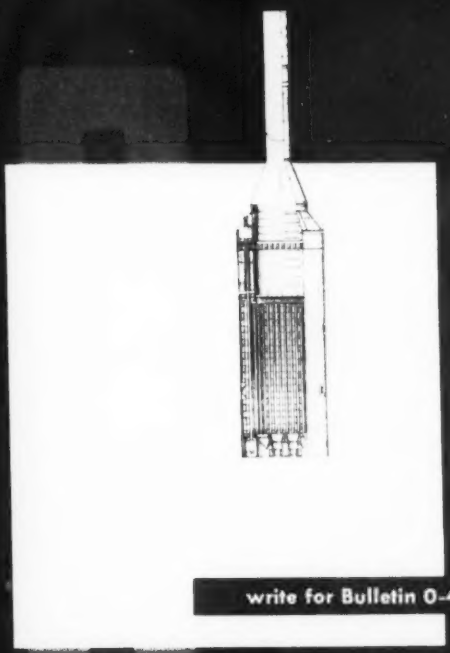

write for Bulletin 0-49-7

what the flame sees

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simplified
vertical tubular heater
the flame sees only
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refractory linings

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Foster Wheeler has designed and constructed **1040** direct fired heaters

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plus values in heater design

180,000,000 BTU/hr.

6,000,000 BTU/hr.

we've built 1040 of them...

...1040 major problems in heating crude petroleum or its intermediates...1040 instances of working with refiners meeting their heating specifications. This long collaborative experience is, we believe, the major factor in creating the plus values in direct fired heaters designed and constructed by Foster Wheeler.

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AMERICA'S STANDARD

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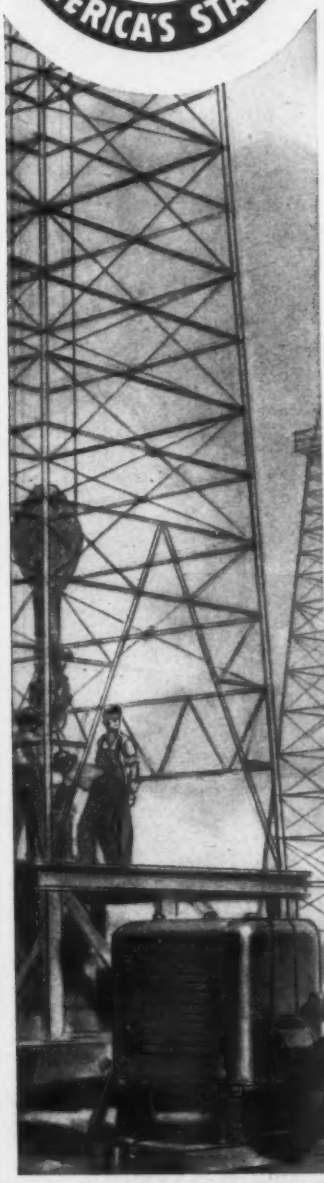
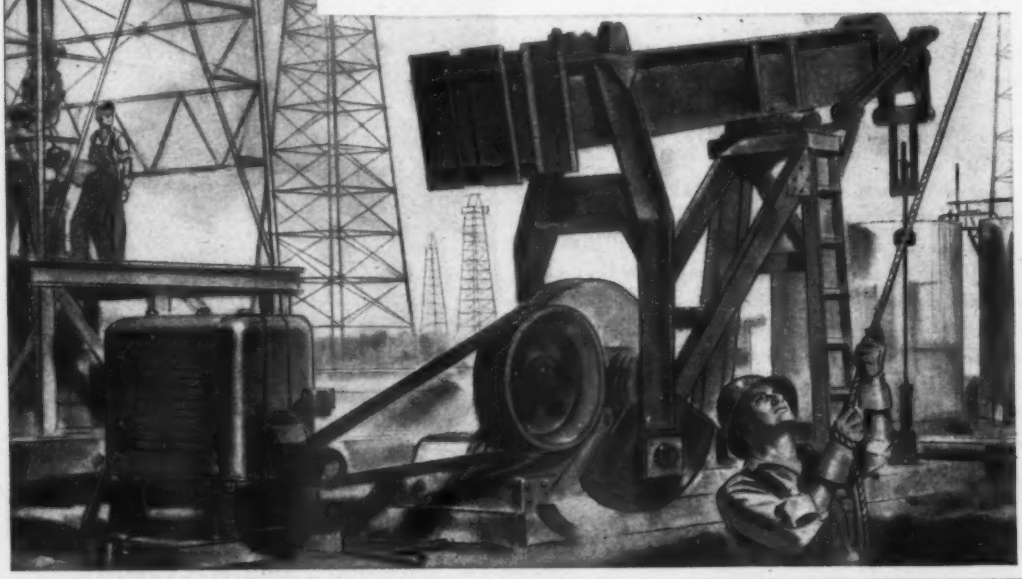


When choosing power for oil field use, keep two things in mind:

1. ***The more closely the power plant is engineered to its job, the better its performance and the lower your operating costs.***
2. ***Whatever the specific need, there's a Continental Red Seal engineered and built to meet it—not approximately, but "right on the nose."***

Continental builds prime movers matched to the needs of most drill rigs, and models for workover rigs, transfer pumps, mud pumps, winches and auxiliary drilling equipment, as well as for standby use with generators, pumps and processing equipment. Since it manufactures to more than 1,000 different specifications, there are one or more built-for-the-job models for virtually every oil field application within the broad power range spanned by the Continental line.



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● Because of the extreme dampness over water, extra precautions had to be taken to protect the cement stored on this drilling tender. Lectrodryer eliminates that problem by circulating warm, DRY air through each compartment.

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This is an unusual application—few men will have need for one like it. But it demonstrates the ability of Lectrodryers and Lectrodryer engineers to handle every kind of DRYing job. It's evidence that there's no need for your engineers to spend time designing special equipment to DRY air, gases or organic liquids when a Lectrodryer has already been built to do it.

For this help, write Pittsburgh Lectrodryer Corporation, 325 32nd Street, Pittsburgh 30, Pennsylvania.

In England: Birlec, Limited, Tyburn Road, Erdington, Birmingham.
In Australia: Birlec, Limited, 51 Parramatta Road, Glebe, Sydney.

This Lectrodryer feeds DRY air into the bins before and after taking on a load of cement.

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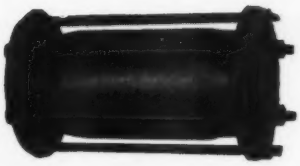
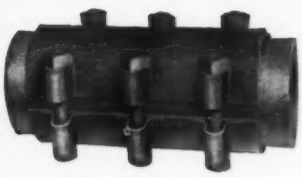


DRESSER LONG SLEEVES

(Style 40) simplify pipe joining. Span gaps between pipe ends. No threading, exact fitting or aligning. Ideal joint at wells, separators, pumps, engines and tanks.

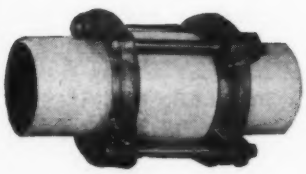
DRESSER COUPLINGS

(Style 38) speed laying of field, gathering and transmission lines; save time on hookups; absorb vibration at pumps, engines and compressors. 100% salvageable in relocating temporary lines.



DRESSER SPLIT REPAIR CLAMPS

(Style 79B) for quick repair of pitholes and longitudinal splits in pipe. Furnished with either one or two shells—an inexpensive "bandage" which saves cutting out short sections of damaged pipe.



DRESSER COLLAR CLAMPS

(Style 4,41) stop leaks through threads of screw collars, without service interruption. Band Clamps (Style 77B), Porous Weld Clamps (Style 55), and other pipe repair devices also available.

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7. **EASY TO WELD**—Low carbon steel welds readily . . . makes sound joints.
8. **FREEDOM FROM SCALE**—Insures against clogged valves, contamination of petroleum products.
9. **LONG LENGTHS**—Reduces number of joints . . . makes jobs move with longer strides.
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—Republic Electric Weld Line Pipe is made from flat-rolled steel both sides of which are closely inspected. Thus, you are assured that the surface which becomes the inside wall when formed into pipe is free from hidden defects.

. . . Another Republic Electric Weld Pipe Line — 150 Miles Long

● During construction of this 12¾" gasoline line out of Tulsa, a complicated cross-over bend had to be made near Bartlesville, Oklahoma.

Here again, the *high ductility steel* found in every length of Republic Electric Weld Line Pipe proved its value in speeding field bends. This section of the line took the bend in stride and hurried on toward completion.

Easy bending, high ductility steel is but one of the "plus" features this up-to-date line pipe offers you. It's out in front on all 10 counts listed here.

They're the reasons why more than 55,000 miles of Republic Electric Weld Line Pipe have been laid during the past twenty-one years, carrying crudes, gasoline, natural gas and by-products.

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Equally important, however, is Jenkins Engineering Service. Providing information you need to select the alloy or type of valve which will render the best service (based on analysis of specific information about the valve installation), Jenkins engineers can be of valuable assistance.

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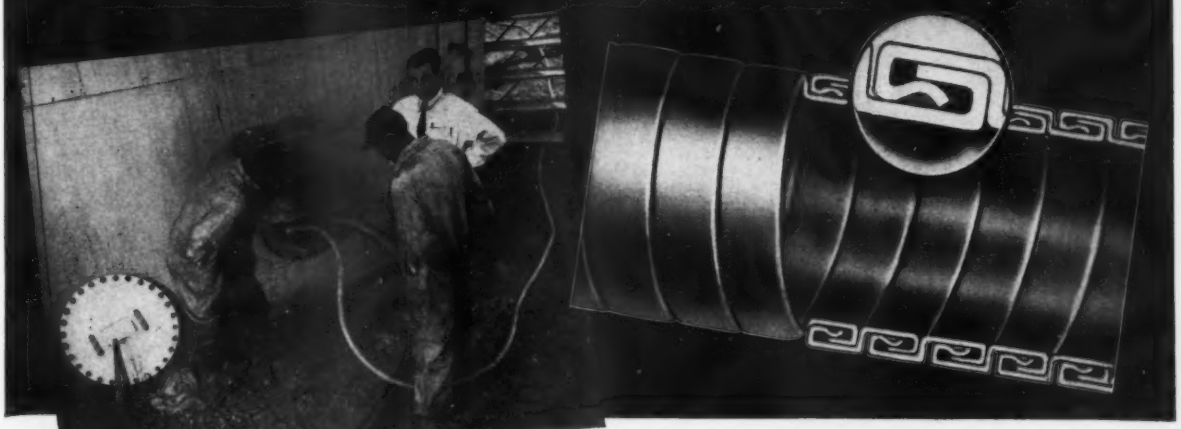

Top photo—CMH REX-TUBE Type RT-15 being used to steam out a storage tank. Middle photo—CMH REX-TUBE Type RT-15 used as a gas connection for a furnace. Bottom photo—CMH REX-TUBE Type RT-15 used for unloading a tank car.

CMH REX-TUBE Interlocked Flexible Metal Hose

IF you convey steam, tar, asphalt, vegetable oils, hydrocarbons or similar substances between relatively movable parts, CMH REX-TUBE Type RT-15 flexible metal hose does the job economically and dependably. REX-TUBE Type RT-15 combines the long life and durability of metal with an exceptionally high degree of flexibility. Further, it is non-aging, non-contaminating and non-collapsible.

REX-TUBE Type RT-15 is of fully interlocked design in bronze or steel with asbestos packing. (See cross-section above.) Suitable for temperatures up to 600° F; pressures to 500 psi. Sizes range from ½″ I.D. through 12″ I.D.

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The exteriors may look alike— but *what a difference inside!*

Inside one home, life goes on smoothly and harmoniously. But in the house next door there's constant friction and nerve-wearing turmoil.

Compare the outside appearance of any standard Powell valve with that of any other valve of the same type and size. You will probably notice very little difference. But inside—that's another story.

There design, materials and manufacturing skills make the difference between a Powell Valve—built to operate smoothly and efficiently over a long period of time—and a valve that will have only a short life before it requires maintenance or even replacement.

Powell also makes many *exclusive* patterns to meet the requirements of special services. In these, too, long trouble-free performance is a primary consideration.

Fig. 559—125-pound Iron Body Bronze Mounted Swing Check Valve with flanged ends, bolted flanged cap and regrindable, renewable bronze seat and disc. Disc when wide open, permits full, unobstructed flow through the valve body. →

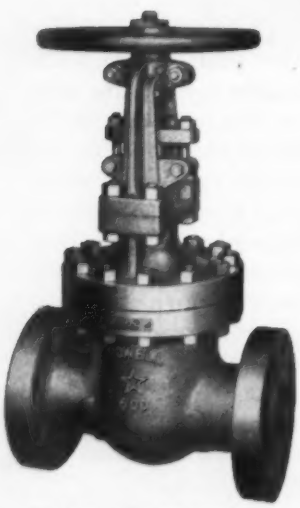

Fig. 6003—Class 600-pound Cast Steel Gate Valve. Flanged ends, outside screw rising stem, bolted flanged yoke, tapered solid wedge.

Fig. 1375—200-pound Bronze Gate Valve with screwed ends, inside screw rising stem, union bonnet and renewable wear-resisting "Powellium" nickel-bronze seat rings and disc.

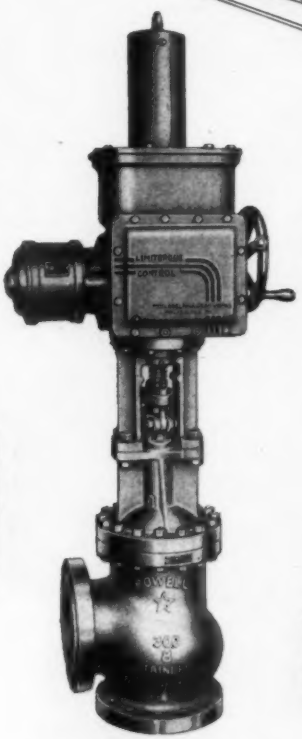

Fig. 3053—Class 300-pound Cast Alloy Steel Angle Valve. Streamlined areas through the body assure maximum flow with minimum pressure drop. Adapted for high temperatures—up to 1400 F. Top-mounted electric motor operator.

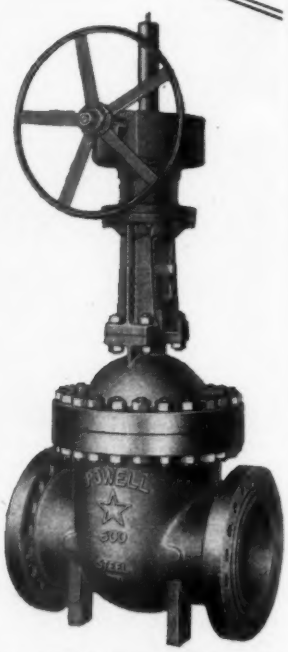

Fig. 6079—Class 600-pound Cast Steel Gate Valve for Pipe Line Service. Bevel gear operation. Can also be furnished with motor operator. Classes 150, 300 and 400-pound valves also available.

The Complete Powell Line includes Globe, Angle, "Y", Gate, Check, Non-return, Relief, and Flush Bottom Tank Valves in Bronze, Iron, Steel and a wide range of Corrosion-resistant metals and alloys.

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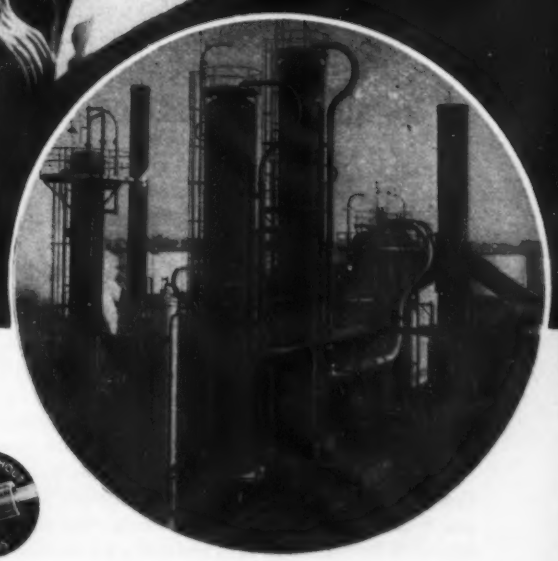
Low Carbon	5 Cr, ½ Mo, Ti
Low Carbon, ½ Mo	7 Cr, ½ Mo
Low Carbon, 1 Mo	8 Cr, ½ Mo
½ Cr, ½ Mo	8 Cr, 1 Mo
1 Cr, ½ Mo	9 Cr, ½ Mo
1¼ Cr, ½ Mo	9 Cr, 1 Mo
2 Cr, ½ Mo	12 Cr, Al
2 Cr, ½ Mo, 1¼ Si	17 Cr
2¼ Cr, 1 Mo	27 Cr
2½ Cr, ½ Mo, ¾ Si	18-8
3 Cr, ½ Mo, 1¼ Si	18-8 Ti
3 Cr, 1 Mo	18-8 Cb
5 Cr, ½ Mo	18-8 Mo
5 Cr, ½ Mo, 1½ Si	25-20



HERE at National Tube, we have developed 28 different analyses of still tubes, condenser and heat exchanger tubes, and refinery piping that will accommodate practically every condition of corrosion, oxidation, temperature, pressure and exposure. And our method of manufacture gives you a *seamless* tube. No welds. No joints—nothing to weaken the tube.

But remember: even with such a wide choice at your command, the selection of the proper alloy requires careful consideration. Otherwise you may end up with tubing that either does not give maximum performance or costs more than necessary.

That's why—to obtain optimum results at minimum cost—we suggest that you submit your problem to our engineers *before* you select new tubing or piping. Our huge file of successful refinery applications means that there's a good chance that we have encountered and *solved* problems just like yours before. And in case your application involves conditions that are entirely new, the wide experience of our experts will be of material assistance in finding the best solution possible.

Use this skilled background. For information, write to National Tube Company, Frick Building, Pittsburgh 19, Pennsylvania.

NATIONAL TUBE COMPANY, PITTSBURGH, PA.

(Tubing Specialties Division)

COLUMBIA STEEL COMPANY, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS · UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS

NATIONAL SEAMLESS PIPE AND TUBES

UNITED STATES STEEL

XUM

It's the Nash!

There are no mechanical complications in a Nash Compressor. A single moving element, a round rotor, with shrouded blades, forming a series of buckets, revolves freely in an elliptical casing containing any low viscosity liquid. This liquid, carried with the rotor, follows the elliptical contour of the casing.

The moving liquid therefore recedes from the rotor buckets at the wide part of the ellipse, permitting the buckets to fill with gas from the stationary Inlet Ports. As the casing narrows, the liquid is forced back into the rotor buckets, compressing the gas, and delivering it through the fixed Outlet Ports.

Nash Compressors produce 75 lbs. pressure in a single stage, with capacities to 6 million cu. ft. per day in a single structure. Since compression is secured by an entirely different principle, gas pumping problems difficult with ordinary pumps are often handled easily in a Nash.

Nash simplicity means low maintenance cost, with original pump performance constant over long periods. Data on these pumps sent immediately on request.

No internal wearing parts.

No valves, pistons, or vanes.

No internal lubrication.

Low maintenance cost.

Saves floor space.

Desired delivery temperature automatically maintained.

Slugs of liquid entering pump will do no harm.

75 pounds in a single stage.

NASH ENGINEERING COMPANY
322 WILSON, SO. NORWALK, CONN.

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ALUMINUM . . . BRASS . . . COPPER . . . MONEL*
NICKEL* . . . STEEL . . . STAINLESS STEEL
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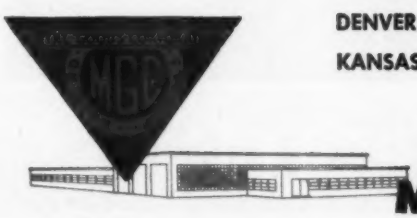
KANSAS CITY 16, MISSOURI	1300 Burlington	NOrclay 3516

*Not warehoused in Kansas City or St. Louis.



METAL GOODS CORPORATION

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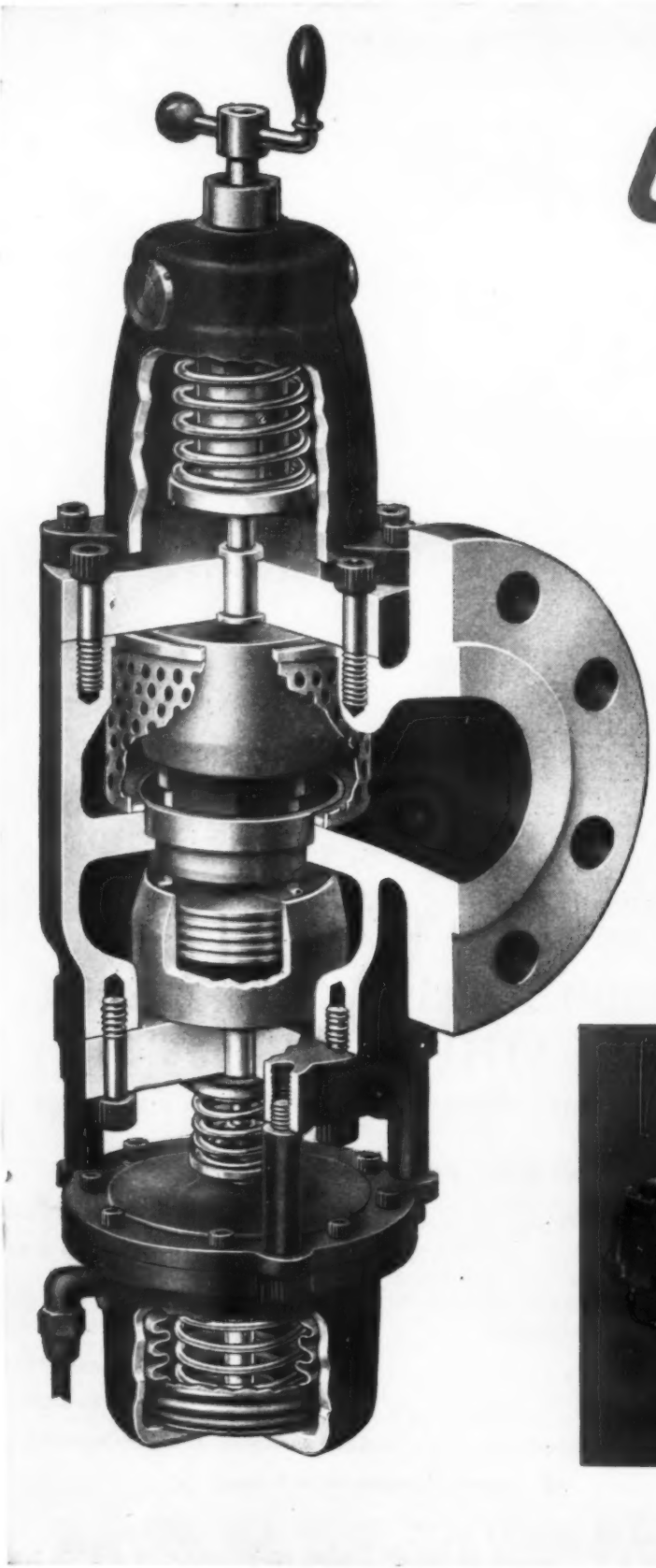
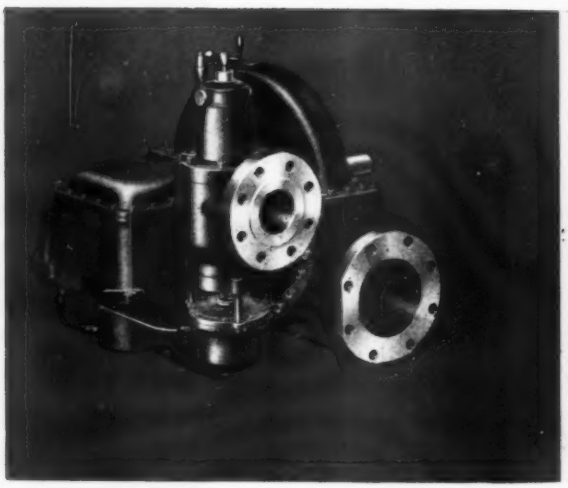


GET THE

GE

TYPE DP



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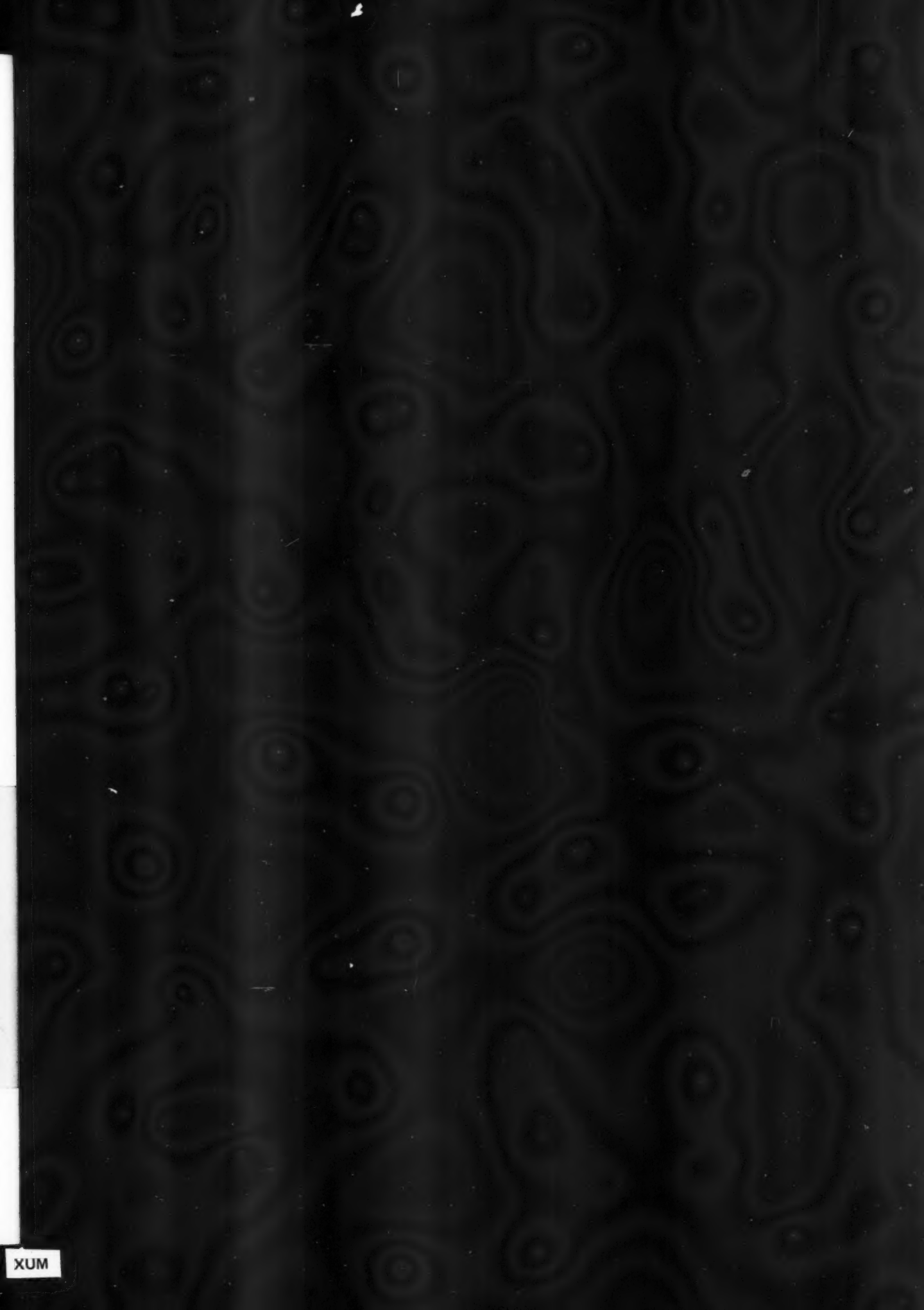


BEST IN VALVING

WITH STANDARD TURBINE DRIVES

On General Electric's standard Type DP mechanical-drive turbine, the trip-throttle valve and the governing valve are combined into one casing. This exclusive G-E feature provides a compact and neat design which simplifies piping by usually eliminating the need for a separate valve in the steam line. You get easier operation, too, because pressures across the valves are equalized. The throttle valve mechanism is ball-bearing mounted, and only hard packings are used.

POSITIVE OVERSPEED PROTECTION

A bolt-type emergency governor, mounted in the turbine shaft, actuates a trip mechanism when speed rises 15% above normal. This action trips the throttle valve closed, positively shuts off steam flow to the turbine. A convenient hand lever is also provided for tripping the valve.

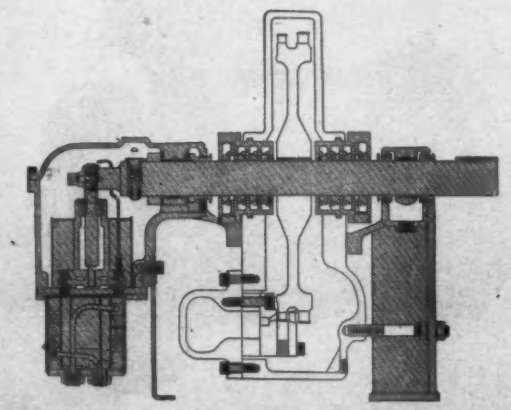
BETTER GOVERNING AND REGULATION

Working with the DP's powerful hydraulic governor, the governing valve gives you greater performance accuracy. The balanced reaction design reduces valve unbalance to a minimum. Relief holes equalize pressure between the valve and the guide piston of the seat. Hard packing decreases the force required to move the valve, results in smoother operation.

LONG LIFE AND DEPENDABILITY

The stainless steel stem and nitrided stainless steel valve and seat are designed to last for years. Maintenance is cut through the use of corrosion-resistant labyrinth stem sealing bushings. No soft packings are used. An easily removable monel steam strainer in the throttle valve chest halts foreign material before it can reach valve or steam parts.

Look into *all* the features of the standard DP turbine. You'll find many extras, such as the valving, which can give you the performance and savings you want from a mechanical-drive turbine. Contact your nearest G-E sales office, or write for bulletin GEA-4955. *Apparatus Dept., General Electric Co., Schenectady 5, N. Y.*



HOW STANDARDIZATION WORKS FOR YOU

In the diagram at the left, all shaded parts are interchangeable on all sizes of DP turbines. Thus, it is easy to stock spares, and maintenance costs are reduced. All models have standard shaft height and coupling fits for easy installation or re-location in your plant. Standardization cuts manufacturing expense and the savings are passed on to you in the form of extra features, usually found only on "special" turbines.

GENERAL ELECTRIC

252-46

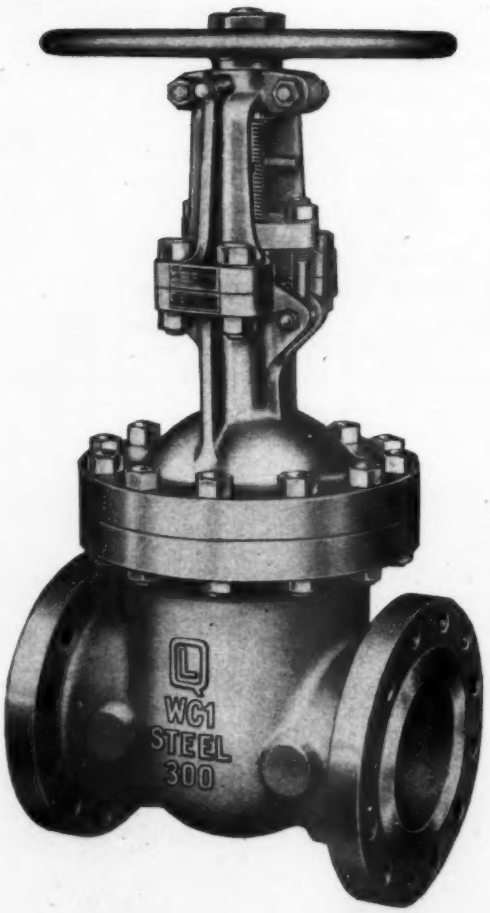
XUM

LUNKENHEIMER
. . . The Steel Valve With A Priceless Ingredient

Into every heat of Lunkenheimer molten steel goes one ingredient that no other valve foundry can duplicate. It's not measured in ounces or pounds — but in generations . . . of tradition. It is pride in the kind of workmanship that has made Lunkenheimer universally respected as the one *great* name in valves.

Engineers are accustomed to dealing in facts — not intangibles. But every realistic engineer knows that molten steel is tricky stuff to handle. It demands *more* from the workman than simple attention. Quality valves—safe valves—are not made by formula alone, but by care . . . interest . . . pride in an unbroken tradition of fine workmanship. At Lunkenheimer, that tradition goes back to 1862.

Lunkenheimer's priceless ingredient will always be intangible, but it can be expressed in terms of one interesting fact: *there is no instance on record where a Lunkenheimer steel valve has ruptured due to defective metal.* For more facts — and for information relating to your specific steel valve application — write immediately to The Lunkenheimer Co., P. O. Box No. 360F, Annex Delivery Station, Cincinnati 14, Ohio.



STEEL • IRON • BRONZE

LUNKENHEIMER
THE ONE *Great* NAME IN VALVES

L-750-13C

Today it's Roebling!

As rotary drilling lines, Roebling 6x19 Preformed "Blue Center" Steel Wire Rope with Independent Wire Rope Core has demonstrated extra life on the job and substantial dollar savings.

Why men who watch costs... specify Roebling Preformed

THE RECORDS PROVE IT... that Roebling Preformed "Blue Center" Wire Rope stays on the job longer and cuts your costs. This is partly because "Blue Center" steel—developed and made only by Roebling—has unsurpassed resistance to abrasion, shock and fatigue. In large measure, too, it is because of the painstaking care, special techniques and modern precision machines that guard and maintain Roebling quality leadership.

Preformed a big help, too. Wide experience in the field proves that Roebling *Preforming* brings still more operating economies. Preformed is easier and faster to handle and install. You can cut it without seizing. It winds better... is not apt to set or kink... minimizes vibration and whipping.

Today's best buy. Roebling makes wire rope of every construction, grade and size ... engineered for top efficiency on every type and make of rope-rigged equipment. Have your Roebling Field Man recommend the *right* rope for best, low-cost performance on each installation. John A. Roebling's Sons Company, Trenton 2, N. J.

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A CENTURY OF CONFIDENCE
DISTRIBUTED BY
THE NATIONAL SUPPLY COMPANY
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New Value

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esign... Performance... Standardization

MASONEILAN
Air Operated
CONTROL VALVES

Mason-Neilan is building a new line of control valves including heretofore unobtainable refinements in design and manufacture which demonstrate again the continuing leadership of Mason-Neilan experience and know-how in this important field.

The valves are more compact; are highly responsive to very small changes in diaphragm pressure; are built throughout for greater than usual strength. Other features are designed to provide even greater usefulness — better-than-ever control. Moreover — of special importance to all users — precision tools and manufacturing methods insure exact reproducibility of essential parts.

For details of design and construction, watch these pages in future issues — for specification data write for bulletin.

MASONEILAN

REG U.S. PAT. OFF.

MASON-NEILAN REGULATOR CO.

1185 ADAMS STREET, BOSTON 24, MASS., U. S. A.

Sales Offices or Distributors in the Following Cities: New York • Syracuse • Chicago St. Louis • Tulsa • Philadelphia • Houston • Pittsburgh • Atlanta • Cleveland • Cincinnati Detroit • San Francisco • Salt Lake City • El Paso • Boise • Albuquerque • Charlotte, N. C. Los Angeles • Denver Mason-Neilan Regulator Co., Ltd., Montreal and Toronto

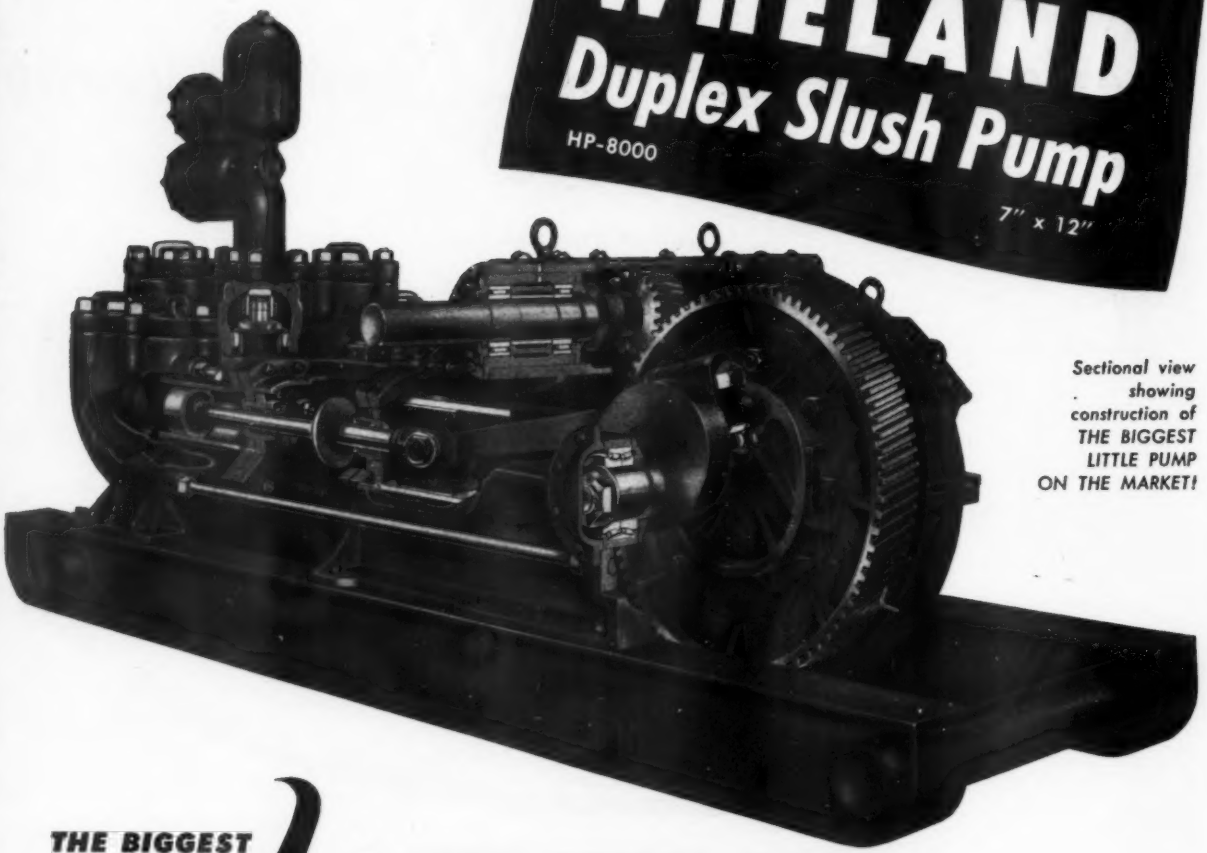
Visit the Fifth National Instrument Exhibit at Memorial Auditorium in Buffalo, Sept. 18-22, 1950.
See our display in Booths Nos. 418, 420 and 422.

XUM

THE MOST ACCESSIBLE PUMP EVER BUILT!

WHELAND
Duplex Slush Pump
HP-8000

7" x 12"



Sectional view showing construction of THE BIGGEST LITTLE PUMP ON THE MARKET!

THE BIGGEST LITTLE PUMP ON THE MARKET NOW HAS

- **NEW SPIRAL GEARS**
  TAKES LESS POWER, IS SMOOTH, FREE FROM VIBRATION
- **STEEL FLUID END**
  GREATER STRENGTH WITH LESS WEIGHT. CAN BE FIELD WELDED.

Already one of the most popular pumps ever built, the Wheland HP-8000 takes another step far ahead! It still has every one of the tried and true features that made it world-famous for performance and dependability. It is just as accessible, still has that outstanding lubrication system and those trouble-free bearings. It still has that exclusive Wheland tie rod construction that gives rugged strength in minimum weight. Now it is easier to run, is free from vibration and runs like a whisper . . . the steel fluid end has greater strength with less weight and can be field welded. Since so many users like the alloy iron fluid ends so well, we will continue to make them, too. Whether you prefer the alloy iron or the steel fluid end, the Wheland HP-8000 will continue to enhance its reputation as the BIGGEST little pump on the market. *Write for mechanical details.*

WHELAND

THE WHELAND COMPANY, CHATTANOOGA, TENN., U. S. A.
ROTARY DRILLING MACHINERY

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DRAW WORKS • SLUSH PUMPS • ROTARIES • SWIVELS • CROWN BLOCKS • TRAVELING BLOCKS

MORE and MORE WELLS ARE PUMPED BY *LCP EVERY DAY!

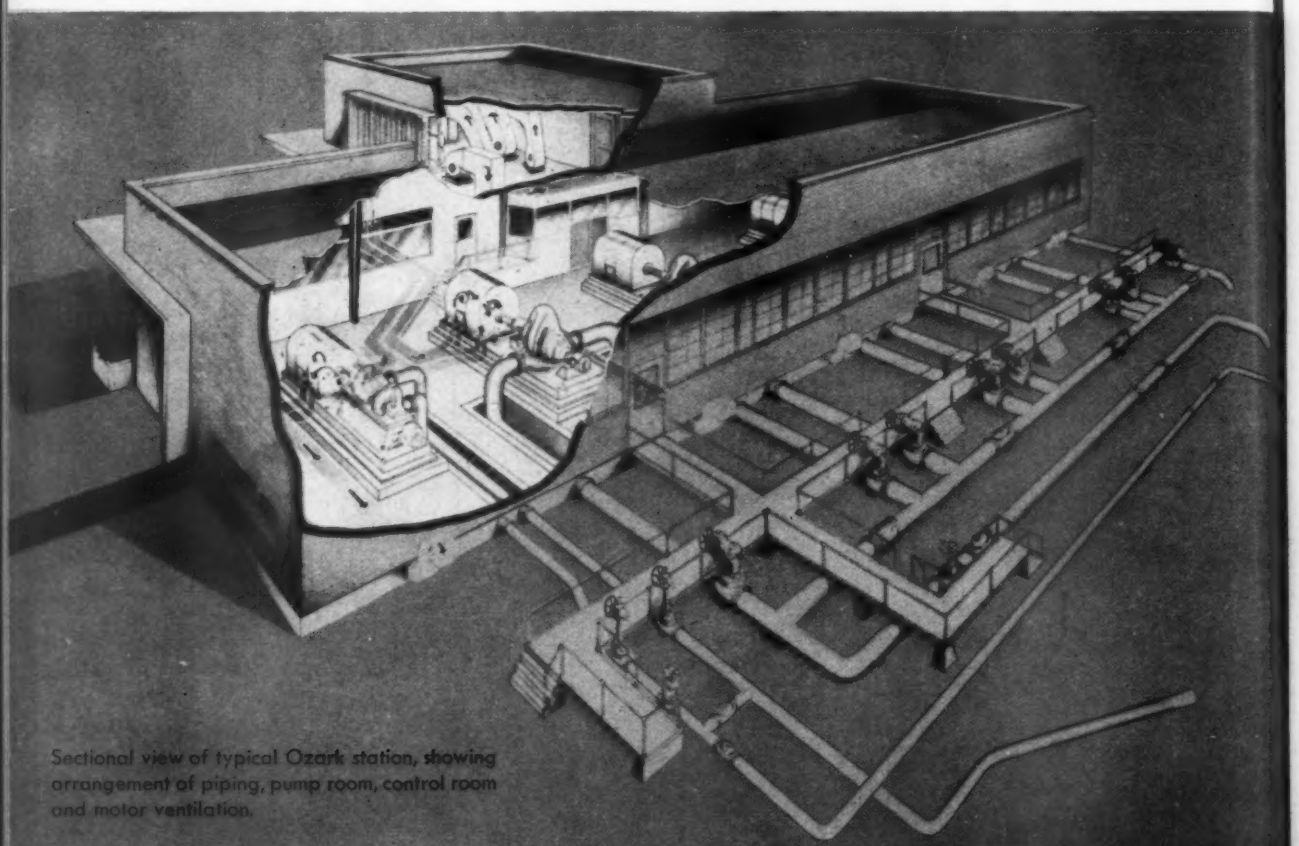
Yes, sir . . . that's me they're talking about . . . *LCP! My AUTOMATIC CONTROL releases manpower, cutting payroll costs. Continuous, trouble-free operation reduces maintenance costs, too. I can take on 24-hour duty or work according to any fractional time schedule—that means you pay only for the power you use. Switch to tireless automatic *LCP! I'll do the job better—for less! Ask the Power Engineer of your Utility Electric Power Company—he'll tell you!

*LOW COST POWER

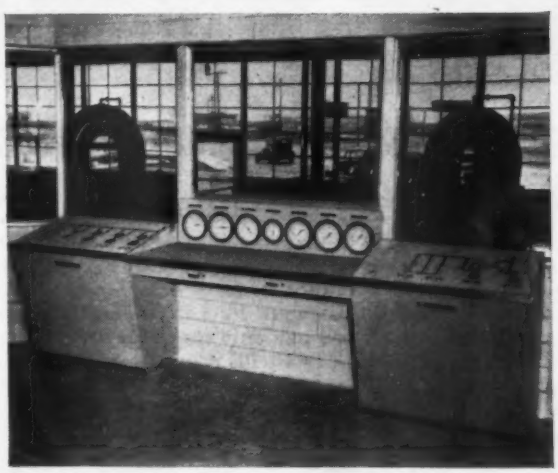
PETROLEUM ELECTRIC POWER ASSOCIATION

YOU CAN BE **SURE**.. IF IT'S

Westinghouse



Sectional view of typical Ozark station, showing arrangement of piping, pump room, control room and motor ventilation.



The control desks for the pumping station are located in the operating room overlooking the pump room. Separate desks are provided for the 22-inch line and for the 10-inch lines.

Main pump motor control is Westinghouse 4,160-volt Metal-Clad Switchgear, with air circuit breakers of 100,000-kva interrupting capacity.

XUM

Complete Electrification

gives Ozark "Big Inch" automatic operation

"The mere pressing of three buttons by a single employee, performs twelve operations in six minutes, that would normally take two or three men an hour."

This statement before the Petroleum Electric Power Association describes experience on the new Ozark "Big Inch" oil pipeline. And it typifies the efficiency and economy of electrified pipelines, for with a revenue of $50 per minute depending upon quick start-up, the savings to be gained are obvious. But greater ease of control is only one way in which savings are gained. Complete electrification (by Westinghouse) of all of Ozark's pumping stations has also provided . . .

Greater flexibility—because over its 426 miles of 22-inch line, and modernized parallel 10-inch line, all stations can be operated "in step". This eliminates the necessity of storing successive pumpings in station balance tanks where the possibility of costly inter-batch contamination exists.

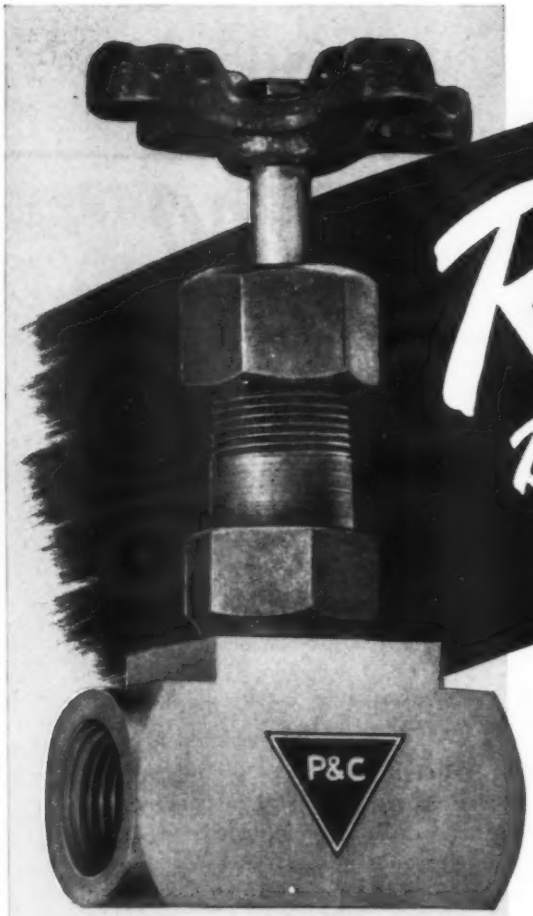
Greater reliability—because simplified electrical operation permits operating schedules to be easily maintained. The possibility of costly errors by station personnel, where many operations must be performed in sequence, is eliminated.

These important advantages plus greater safety, cleanliness and compactness of plant, explain today's trend to complete electrification. And these same advantages are available to you. Westinghouse can supply the equipment . . . the specialized engineering help . . . everything you'll need for complete electrification. So for dependable power apparatus . . . for undivided responsibility, come to Westinghouse . . . and be Sure! Just call your nearest Westinghouse office or write: Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-94853

Westinghouse

EQUIPMENT FOR THE PETROLEUM INDUSTRY

XUM

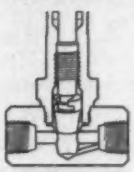


R-P&C BAR STOCK VALVES

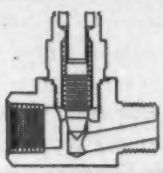
RUGGED
ECONOMICAL
DEPENDABLE
VERSATILE

Following is a tabulation of working pressures of these valves:

MATERIAL	FIGURE NO. Globe	Angle	WORKING PRESSURE
Bronze	1030	1031	500 lbs. at 150°F
Carbon Steel	1040A	1041A	4000 lbs. at 150°F
			600 lbs. at 750°F
			550 lbs. at 900°F
			475 lbs. at 1000°F
12-14 Chrome Stainless Steel	1050	1051	4000 lbs. at 150°F
Combination	1060	1061	4000 lbs. at 150°F
12-14 Chrome			600 lbs. at 750°F
Stainless Steel			550 lbs. at 900°F
Carbon Steel			475 lbs. at 1000°F
18-8 Stain. Steel (type 316)	1070A	1071A	4000 lbs. at 150°F
Thru Port Valves 1045A			1000 lbs. at 150°F
			600 lbs. at 750°F
			550 lbs. at 900°F
			475 lbs. at 1000°F

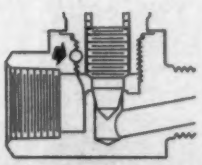


THRU-PORT—for handling heavy liquids which carry suspended solids or where precipitates or deposits cause trouble.

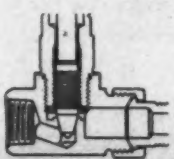


MALE and FEMALE END—Available in both Globe and Angle valves—useful for many special hook-ups.

—(SOCKET WELDING ENDS NOT ILLUSTRATED)—



LOCK BONNET—for lines carrying hazardous liquids or where there is extreme vibration.



UNION END—where frequent disassembly is required or to use instead of a break elsewhere in the line.

For more complete information, get in touch with your Reading-Pratt & Cady distributor or the District Office nearest you.

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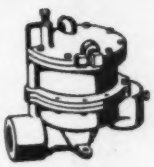
R-P & C VALVE DIVISION
AMERICAN CHAIN & CABLE

TRADE MARK

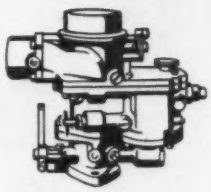
READING-PRATT & CADY VALVES

XUM

Model "Kg1"
Gas Carburetor



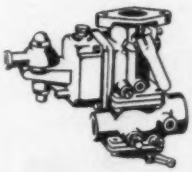
Model "B"
1 in. Regulator



Model "Cg"
Combination Carburetor

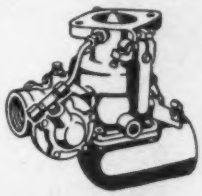
Model "F"
Regulator

Model "R" 125 H.P.
LPG Vaporizer & Regulator

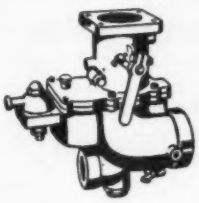


Model "Kgn1"
Combination Carburetor

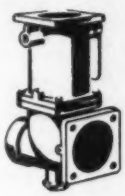
Model "G1"
Gas Carburetor



Model "Xg"
Gas Carburetor



Model 2½ in. "Tg"
Combination Carburetor



Model "A"
Gas Carburetor

ENSIGN
CARBURETION

★ *First in Natural Gas*

★ *First in LP-Gas*

Complete line of Carburetors and Vaporizers

5 to 500 horsepower

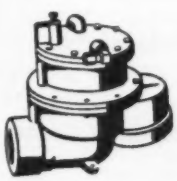
Write us for Complete Information

ENSIGN CARBURETOR COMPANY

7010 S. ALAMEDA ST., HUNTINGTON PARK, CALIF.

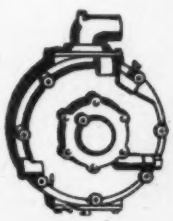
Branch Factory: 2330 West 58th Street, Chicago 36, Illinois

"Pioneers in Efficient Carburetion" • Established 1911

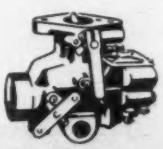


Model "B"
2 in. Regulator

Model "W" 75 H.P.
LPG Vaporizer & Regulator

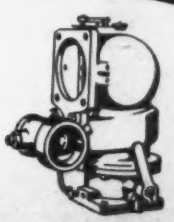


Model "5" 450 H.P.
LPG Vaporizer & Regulator



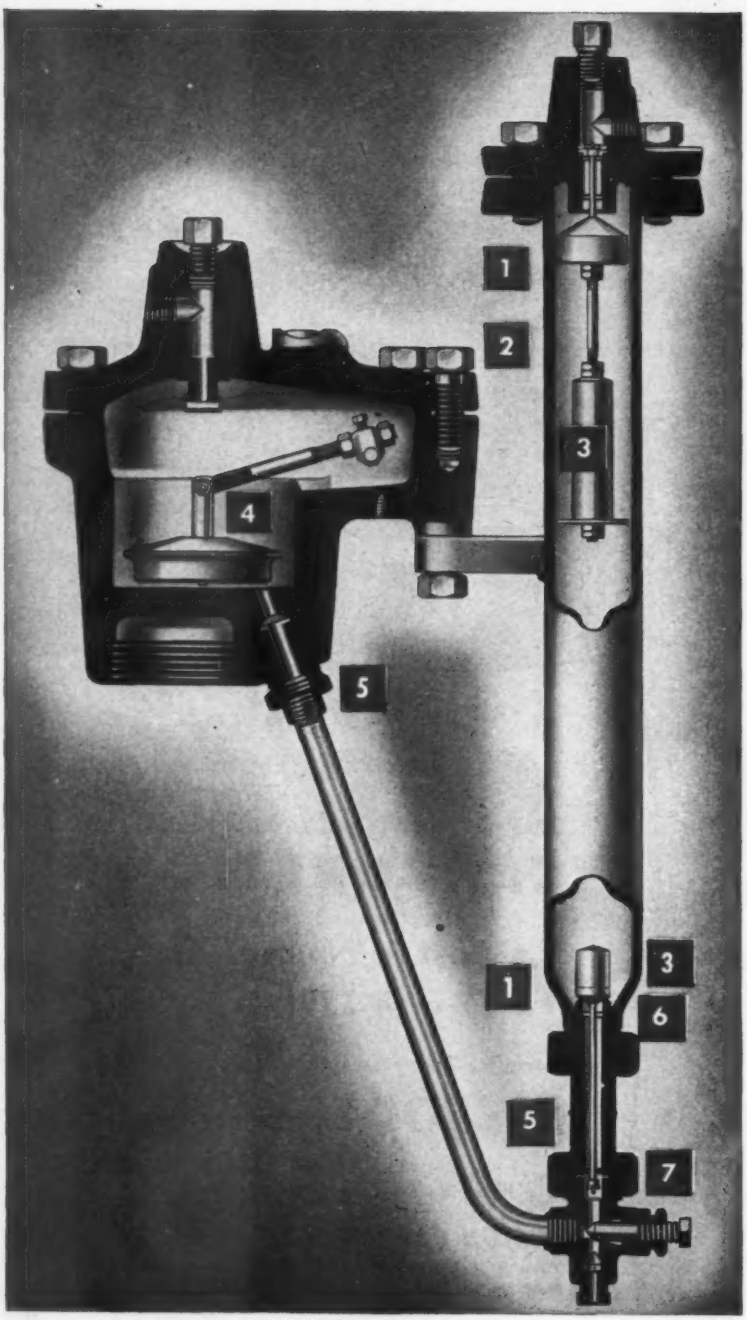
Model ¾ in. "Tg"
Combination Carburetor

Model "HD" 450 H.P.
Vaporizer



Model "Dg"
Gas Carburetor

XUM



A NEW for 1500

1. **New Mercury Check Valves Stainless Steel Seats**
2. **Extended Hi-Side. Prevents Loss of Mercury on Reverse Flows**
3. **Plastic Check Valve Floats**
4. **Float in Low Side for Convenient Adjustment**
5. **Union Type Connections for Interchangeability of Range Tubes**
6. **Swaged Hi-Side Tube**
7. **New Pulsation Dampener**

HIGH PRESSURE IRONCASE METERS
(Bulletin EG-40)

RELIANCE CBVA MOTOR VALVES
(Bulletin 50-A)

DRY TEST METERS
(Bulletin AG-3)

PNEUMATIC TRANSMITTERS AND RECEIVERS
(Bulletin CT-49)

ORIFICE METER
p.s.i. Working Pressure

Among the important operating and service improvements embodied in the American METRIC A-88 Series Orifice Meters are the following:

The mercury float is in the low side chamber, which permits cleaning and calibration with low side cover removed

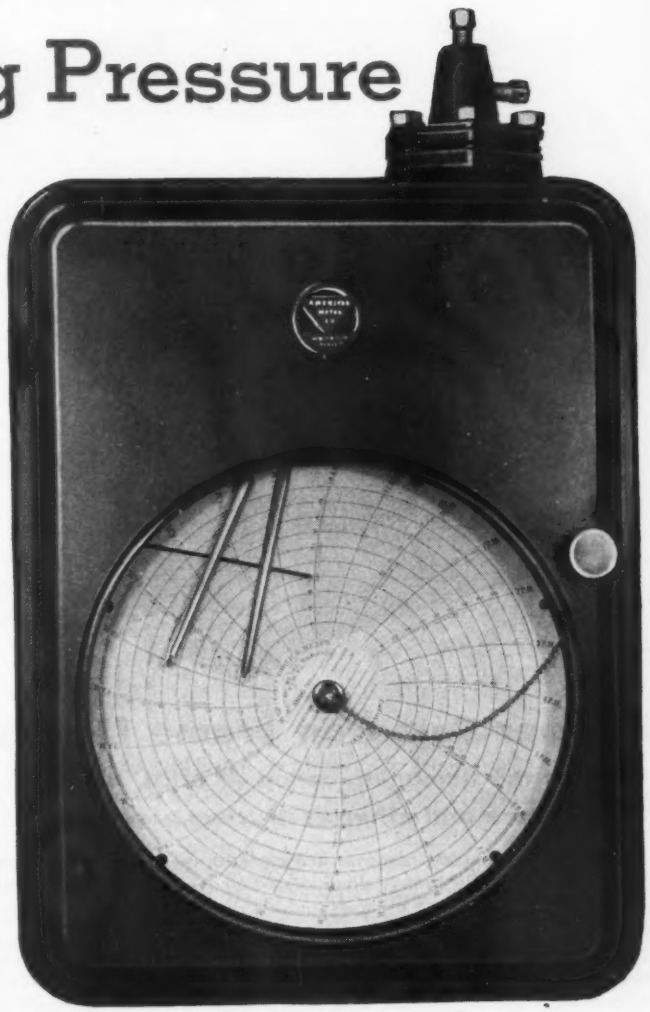
Union type seal tube connections permit interchanging 20", 50", 100" and 200" ranges. Other ranges up to 800" available

Over-range protection is provided by submerged check valve with long guided stem and stainless steel seat

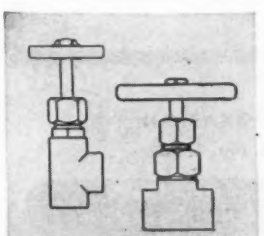
Under-range protection is provided by check valve with stainless steel seat and plastic float in extended high-side chamber

A new Teflon sealed stuffing box with monel shaft requires no grease or other lubrication furnished upon request

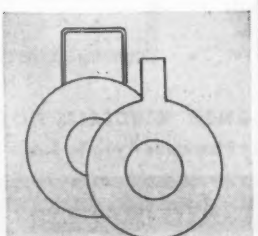
A-88 Series Orifice Meters will handle tough measurement problems. They are rugged, yet simple. They are particularly suitable for applications which must function properly where service inspections may be few and far between. They maintain the American Meter Company tradition of "*sustained accuracy at lower cost.*" Write for Bulletin.



American Meter Company
RECORDING ORIFICE METER
Diff. Range Inches of Water 10—20—50—100—200
Pressure Springs available for all applications



NEEDLE VALVES, SCREWED AND UNION BONNET
(Specification Sheet)



ORIFICE PLATES AND ORIFICE FLANGES
(Bulletin EG-2)

AMERICAN METER COMPANY
INCORPORATED (ESTABLISHED 1836)

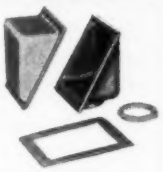
60 East 42nd Street • New York 17, N. Y. • Albany • Alhambra
Atlanta • Baltimore • Birmingham • Boston • Chicago
Dallas • Denver • Erie • Fort Lauderdale • Houston
Joliet • Kansas City • Los Angeles • Minneapolis • Odessa
Philadelphia • Pittsburgh • San Francisco • Tulsa
In Canada—Canadian Meter Co., Ltd., Hamilton, Ontario

XUM

WAGNER MOTORS
...The choice of leaders in industry

IT'S WAGNER *because:*

Moisture-proof and dust-tight cast iron conduit box—screw-on type.



Leads are brought out through threaded nipple and sealed with a flexible compound.

Rugged, corrosion-resistant cast iron frame with inner frame, outer frame and feet cast in one piece.

Wagner Cast Iron Frame Motors

resist the damaging action of acids, fumes, moisture and other destructive elements

Motors used in chemical manufacturing plants, oil fields, coal mines, and in similar applications where corrosion is a problem must be designed to resist damage by acids and alkalies present in the atmosphere in the form of dust, fumes, or moisture.

Wagner cast iron frame motors are built to provide the corrosion-resistance demanded by such applications. They feature well-impregnated, special varnish treated windings protected by totally-enclosed fan-cooled construction . . . a cast iron, gasket sealed conduit box . . . and drain plugs in the endplates for easy removal of any condensation from inside the motor.

These motors are available in ratings from 5 to 250 horsepower, in both standard (type EP) and explosion-proof (type JP) designs.

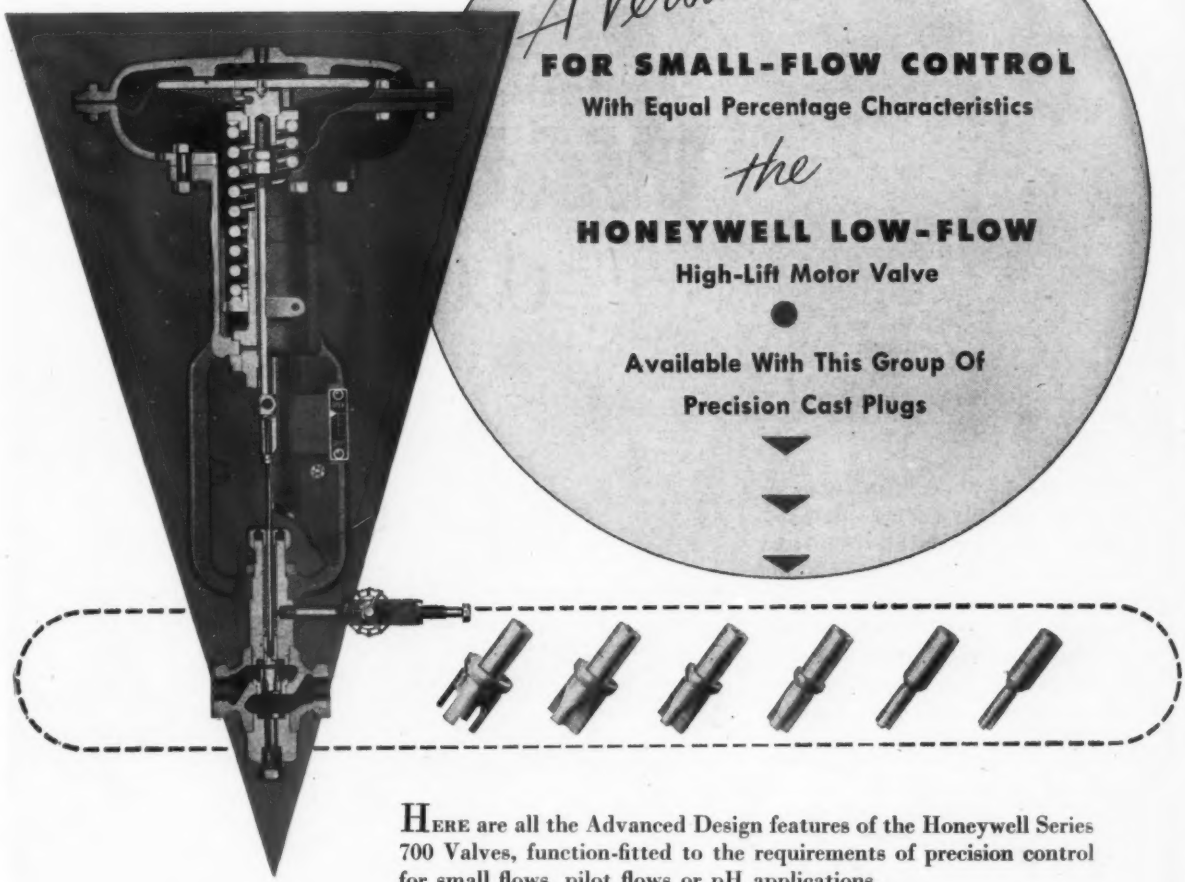
Bulletins give full information on Wagner Cast Iron Motors and on other motors in Wagner's complete line. Thirty-one branches, located in principal cities, are ready to assist you whenever you have a motor problem.

Wagner Electric Corporation
EST. 1891

WAGNER ELECTRIC CORPORATION
6389 Plymouth Ave., St. Louis 14, Mo., U.S.A.

ELECTRIC MOTORS · TRANSFORMERS · INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC

BRANCHES IN 31 PRINCIPAL CITIES



A Versatile Valve

FOR SMALL-FLOW CONTROL

With Equal Percentage Characteristics

the

HONEYWELL LOW-FLOW

High-Lift Motor Valve

●

Available With This Group Of Precision Cast Plugs

HERE are all the Advanced Design features of the Honeywell Series 700 Valves, function-fitted to the requirements of precision control for small flows, pilot flows or pH applications.

The Honeywell Low-Flow is a motor operated valve possessing Premolded Neoprene Diaphragm with Rolling Action, Pivot-Mounted Inner Plate, Cradle-Mounted Upper Spring Flange, Duplex Stem Bearings and One-Piece Bonnet . . . available with a series of different size plugs, each of which changes flow about 7% with every 1% change in stem lift.

This all adds up to a new high in versatility and precision for a critical phase of flow control operations . . . well worth your investigation.

Call in your local Honeywell engineer for detailed information on types of construction, materials, connections, ratings and accessories . . . he is as near as your phone!

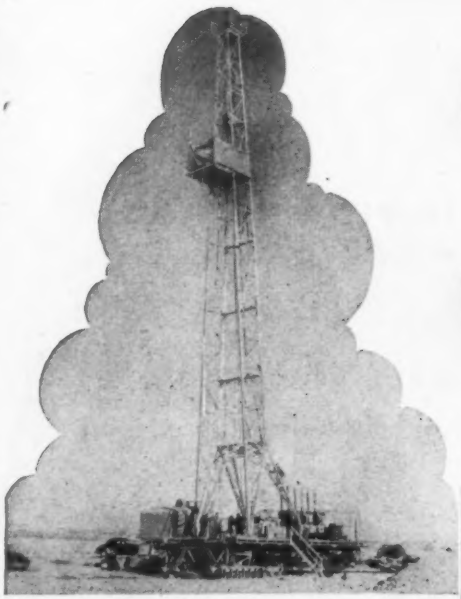
Write, today, for a copy of Bulletin 700-2!

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 1906 Windrim Ave., Philadelphia 44, Pa. Offices in more than 80 principal cities of the United States, Canada and throughout the world.

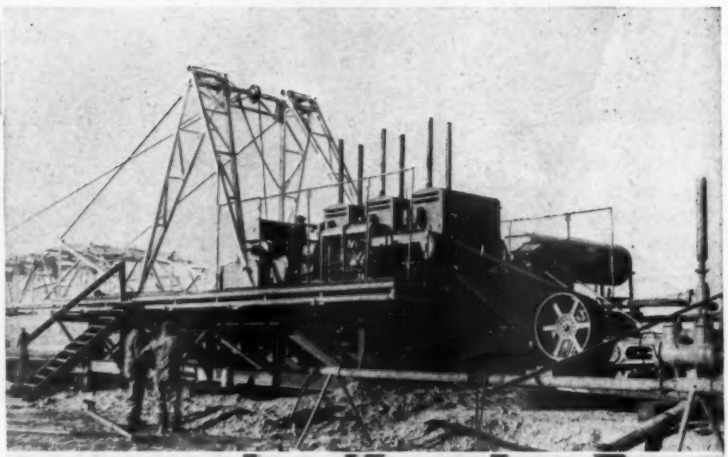
MINNEAPOLIS **Honeywell**

VALVE PRODUCTS

XUM

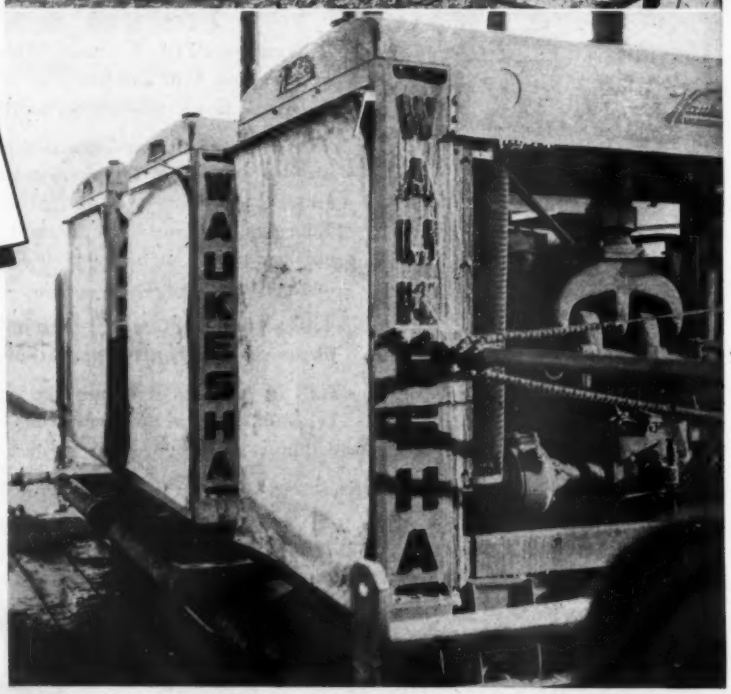


dependable DEEP DRILLING ...faster and cheaper with WAUKESHA diesels



● LOWELL & VOLTZ, Vernal, Utah, are getting super-duty drilling—using this *Unitrig* powered with three Waukesha Super-Duty Diesel Oil Field Units (Model 6-WAKDU) 6 cylinder, 6¼ in. bore x 6½ in. stroke, 1197 cu. in. displacement, governed speed 1300 rpm. It's a potent power producer, this heavy-duty four-stroke cycle, overhead valve Diesel Engine!

Super-Duty Diesel Six Oil Field Units



Rugged but not rough . . . you get the same snappy acceleration with the Waukesha Super-Duty Diesel that you're used to with a gas engine. If you've been using Diesels, you'll appreciate that. Starts promptly, even in cold weather (look at those icicles on the radiator in the picture) with either the Waukesha gasoline starting engine or electric system.

Send for Bulletin 1418

WAUKESHA MOTOR COMPANY • WAUKESHA, WISCONSIN

NEW YORK • TULSA • LOS ANGELES

Why WORTH WELDED STEEL PIPE

. . . because the "Fully Deoxidized" Steel Plate used in Worth Steel Pipe is basically good plate (carefully controlled from the combining of the chemical elements, through open hearth and rolling mill) produced entirely within our own plant under painstaking supervision. This control enables us to produce Pipe that is easier to bend and weld—permits you to "fit-it-up" and "lay-it-down" faster.

Worth Welded Steel Pipe—a product of more than four generations of steel-making—is available in 40′ lengths in 22", through 36" O.D. Deliveries are reasonably prompt. Write for details.

FLANGED AND DISHED HEADS • CARBON AND STAINLESS-CLAD STEEL PLATES

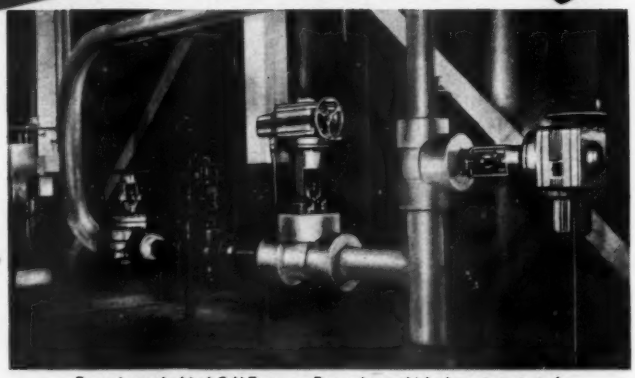
WORTH STEEL COMPANY · Claymont, Delaware

XUM

The Safe Sure Way to operate valves *Automatically*

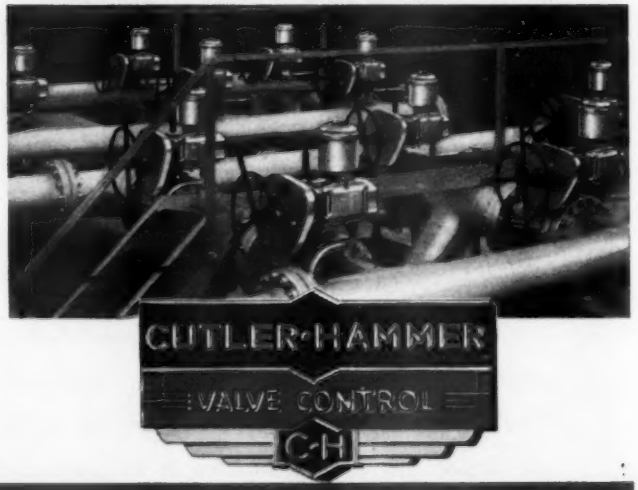
The princi… unique Th… trolled Seati… ture of C-H TNY operators

During seating movement, Fulcrum is at A and drive is *down*, toward the valve seat. At moment of tight seating, Fulcrum *transfers* to B and further drive is *upward*, absorbed harmlessly by the springs to trip the Thrust switch and disconnect the motor.



Experience behind C-H Type TNY operators dates back to 1900, embraces every type of valve application.

For valves which do not seat, such as the plug type valves, C-H B2 automatic declutching valve operators act swiftly and stop instantly.

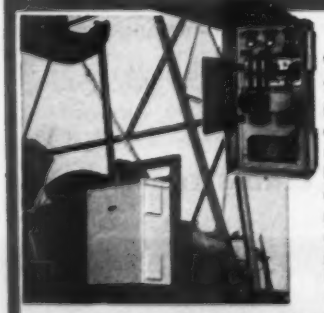


THE problem of mechanized valve operation is the problem of *correctly* seating the valve. The danger is that either the disc is not completely seated, or that the driving force is not cut off soon enough with the result damaging stresses are set up throughout the assembly.

But Cutler-Hammer *Thrust Controlled* Valve Operators not only seat *all* valves under *any* circumstances exactly as they *should* be seated, but because of their ingenious design maintain that degree of tight seating without variation through expansion and contraction of valve parts under the extremes of heat and cold.

It will pay you to investigate Cutler-Hammer Motorized Valve Operators for any and every valve need. CUTLER-HAMMER, Inc., 1453 St. Paul Avenue, Milwaukee 1, Wisconsin.

OTHER CUTLER-HAMMER PRODUCTS FOR THE OIL AND GAS INDUSTRY



Long-lasting control that "schedules" oil well pumping

This Cutler-Hammer Motor Control Device built to the rigid requirements of tough oil country service automatically starts pump going and shuts it down in synchronization with oil well capacity or in conformity to operating schedule. You can set up any sequence of day and night operation, set it to skip certain days. Bulletin 9589D-21 tells all about this amazing pumping control. Send for free copy.

Know what you are buying, selling, giving away

These "gas counting" instruments tell you accurately

Cutler-Hammer Calorimeters . . . standard wherever gas is bought or sold—actually count the B. t. u.'s per cubic foot of the gas you are sending or receiving. Accurate within 1%. They also write a continuous 24-hour a day permanent record so you know at all times exactly what is going through your piping system . . . for accurate accounting and billing, and for accurate control of gas heating value. Free booklet "Where Experience Counts" tells all about C-H B. t. u. Control.

LOW COST

is the pay-off with ALCO AIRCOOLERS

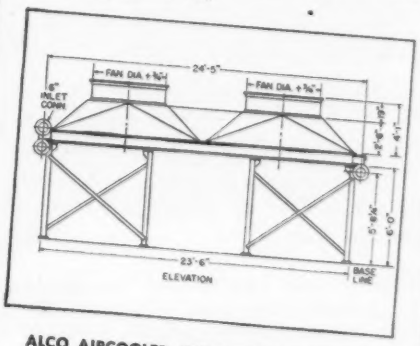
Precision engineering—standardized parts—volume production—plus correct engineering application with proper safety factors—these are the features that give you lifetime operating economies with Alco **Aircoolers** and make them the best buy for your heat exchange dollar.

Proved by performance on some of the largest air-cooled installations in the world, these dependable units can help with your problem, particularly if you have a poor or inadequate water supply. With Alco **Aircoolers** such troubles as scale, costly water treatments and other cooling headaches are eliminated.

For more details send for the free Alco **Aircooler** Catalog, or see your nearest Alco Sales Engineer at Chicago, Cleveland, Houston, Kansas City, Los Angeles, New York or Tulsa. Plants at Dunkirk, N. Y. and Beaumont, Texas.

ONE AIRCOOLER FROM THE ALCO LINE

ALCO Aircoolers like these shown in a large gasoline plant are used in hundreds of installations for cooling jacket-water, gas, engine lube-oils, vapors, etc.



ALCO AIRCOOLER, UNI-BUNDLE MODEL T-1
CONDENSED SPECIFICATIONS

No. of tubes per row—30/29 (staggered pitch).

No. of bundles per unit—One.

Fans—Two or three—5 ft. or 6 ft.

Drive—Direct Electric Motor (V-belt or Gear Drive can be furnished on request).

Face Area—135 sq. ft.

ONLY ALCO HAS THE BIG 5

1 LOW COST
2 Flexible Design
3 Efficient Performance
4 Easy Maintenance
5 Quick Installation

ALCO

ALCO Products Division
AMERICAN LOCOMOTIVE COMPANY

In step with tomorrow — ALCO AIRCOOLERS, Heat Exchangers, Evaporators, Feedwater Heaters, Pressure Vessels, Pipe

XUM

New... designed *and specially for* oil drilling contractors and shops

A Genuine MAGNAFLUX INSPECTION UNIT for DRILLING EQUIPMENT

$485 COMPLETE, with instructions and equipment for dry powder inspection.

MAGNAGLO Accessory kit available (at extra cost) for most sensitive and rapid inspection.

LOCATES NOT ONLY SURFACE BUT SUBSURFACE DEFECTS

. . . no other unit under $1400 approaches its sensitivity and convenience.

WHEN the undisputed leader in magnetic particle inspection offers drilling contractors a *performance-proved* portable inspection unit at $485 — it's news.

When that price includes a full day's instruction by a Magnaflux Field Engineer, the right to use the unit under applicable Magnaflux patents, plus full equipment for dry powder inspection — then it becomes news for you to act upon, and quickly!

The new Magnaflux KH-05 is the kind of inspection unit drilling contractors have asked for — to *depend* upon to stop the exorbitant waste of fishing and on-the-job tool failures. It enables any contractor to detect cracks and flaws in drill collars, kellys and other drilling machinery before they become the source of needless, major expense. In time, money and equipment saved, the KH-05 can repay its small cost over and over in the first year you own it!

It is a genuine Magnaflux, with all that means in perfected dependability and performance . . . the result of 20 years spent by Magnaflux developing magnetic particle inspection.

You owe it to yourself to have the full facts. We'll rush a bulletin to you, if you'll *write today.*

Accessories included for $485.00: 3 magnetizing cables with Eitherend connectors, Magnaflux dry powder and bulb.

Set of prods (not illustrated) available as an optional extra. Also, a full Magnaglo kit can be used with the KH-05.

Accessories for any KH-05 use are conveniently stored and rolled to the job—in generous accessory compartment in the unit.

Only with this Unit a combination of features like these:

- **Easily Portable**
- **Both AC and DC magnetizing current from 110 volt AC line.**
- **Magnetizes any *shape*, assembled or disassembled, with wrap around cables 30' long—and with optional accessory prod kit for current *through* the part.**
- **Permits use of Magnaglo — Proven the most sensitive and rapid inspection medium. Best for cracks in threads or sharp corners.**
- **Dependability assured — built by Magnaflux the pioneers and originators of magnetic particle inspection**

MAGNAFLUX CORPORATION

5928 Northwest Highway • Chicago 31, Illinois

NEW YORK • DETROIT • CLEVELAND

DALLAS, P.O. Box 7104 — Love Field Branch P.O. — Phone Dixon 4-2626

LOS ANGELES, 1566 East Slauson, Phone Jefferson 5273

OPERATES WITH EASE

Cylindrical Plug Valve

Quick turning is an outstanding advantage of a.c.f. design. No wedging in its seat. The precision-machined Cylindrical Plug, pressure lubricated on all seating surfaces is always free to turn. It could be critically important in your plant. Reason enough to give a.c.f. Lubricated Plug Valves preference.

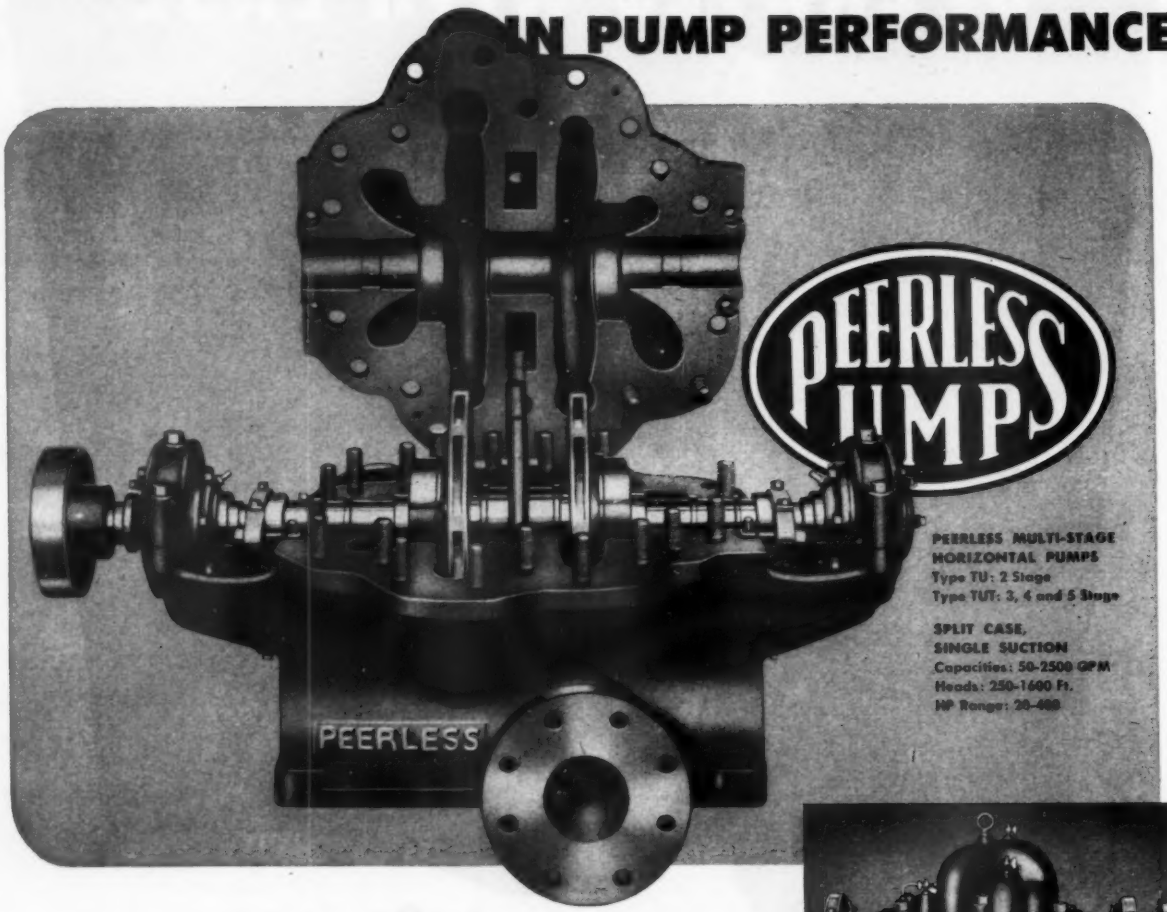
CYLINDRICAL
a.c.f. FULL PIPE AREA PLUG VALVES
LUBRICATED

Representatives in more than 50 Principal Cities.

Ask for catalog 4-OG American Car and Foundry Company, Valve Division, 1501 Ferry Ave., East, Detroit, Mich.

XUM

PEERLESS PROVIDES A PLUS IN PUMP PERFORMANCE



PEERLESS TYPE TU PUMP WITH THE CASE SPLIT FOR A LOOK AT CONSTRUCTION FEATURES

Peerless Type TU and Type TUT multi-stage horizontal pumps squarely meet your requirements where moderate capacity and high head applications in handling boiler feed water and process liquids are involved. In general, these pumps are of horizontal, split-case design. They incorporate a number of features that provide a plus in pump performance without paying a premium on your investment.

For example: Peerless TU and TUT pumps are equipped with duplex angular contact thrust bearings, water cooled bearing housings, heavy stiff case rings, sleeves locked against impeller hubs, in-and-out cooling and sealing connections at stuffing box.

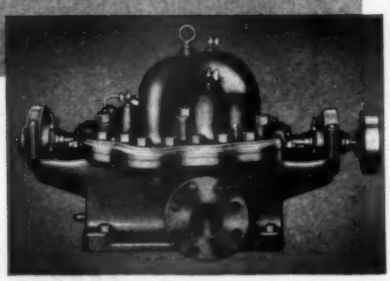
The return passages from discharge to suction of the impellers is the best method developed over a period of years for converting velocity into pressure between stages providing a definite improvement in efficiency.

The high pressure stuffing box on these pumps is under one stage pressure only, regardless of the net pressure developed by the pump.

The spacer bushings between stages are serrated with grooves throughout its length, are longer than competitive pumps thus making an effective seal between stage pressures. The serrations allow closer clearances and minimize any tendency to bind.

Shafts are rugged for the HP involved and will bear comparison with conventional pumps.

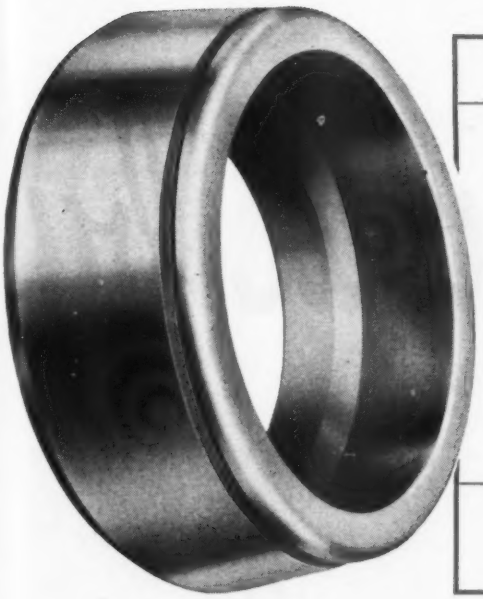
Peerless Type TU and TUT pumps are described in Bulletin B-301. Write for your copy today.



Exterior view of Type TU 2-stage pump showing internal cross-over as furnished on 4" size and smaller.

View in booster station shows Type TUT 3-stage pumps each handling 325 gpm of process water at 600 ft. head.

PEERLESS PUMP DIVISION
FOOD MACHINERY AND CHEMICAL CORPORATION
Factories: Los Angeles, California, and Indianapolis, Indiana.
Offices: New York, Atlanta, Chicago, St. Louis, Phoenix, Fresno, Los Angeles; Dallas, Plainview and Lubbock, Texas; Albuquerque, New Mexico.



HERE ARE THE COST FIGURES:

	BAR STOCK	TUBING
Material costs per 1000 pieces	$79.56	$76.77 —a saving of $2.79
Freight costs per 1000 pieces	$ 3.57	$ 2.18 —a saving of $1.39
Number of pieces produced per hour on 6-spindle 2⅜" capacity automatic screw machine.	80	140
Machining cost per 1000 pieces (estimated machine operating cost—$6.50 per hour)	$81.25	$46.43 —a saving of $34.82

TOTAL COST SAVING WITH TUBING—
$39.00 per 1000 pieces, or 23.7%

Its cost was cut 24% by switching to TIMKEN® seamless tubing

THIS automatic transmission part used to be made from bar stock. By switching to Timken seamless tubing, the manufacturer saved money on material, shipping, and production. This saving amounted to $39 per 1000 pieces, or 23.7%. The figures above tell the story.

With Timken seamless tubing, the center hole is already there. You can often start right off with finish boring. Speeds and feeds can be increased. Scrap loss is reduced.

You have a better quality product, too. Since internal working tools may be flooded better with coolant, the metal is kept cooler; you get closer dimensional control and better finish of machined parts. And because the piercing process which produces Timken tubing is basically a forging operation, you get greater product strength. This fine forged quality is uniform from tube to tube and heat to heat as a result of Timken's rigid control.

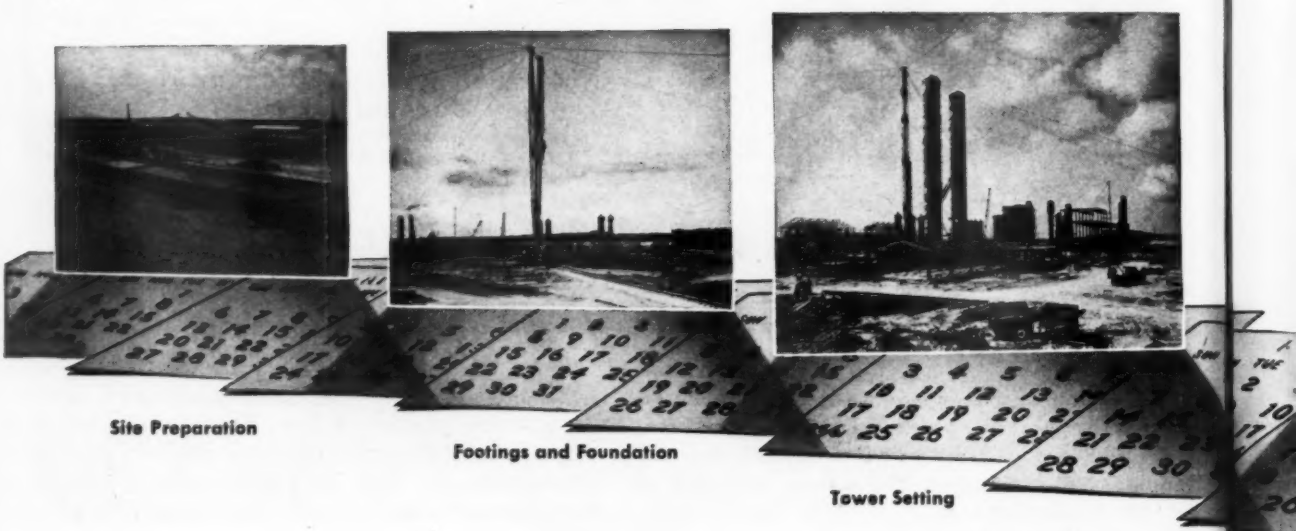
GUARANTEED CLEAN-UP. Let our Tube Engineering Service analyze your requirements and recommend the most economical size tube for your job. The size they recommend will have a minimum of waste and will be guaranteed to clean up to your finish dimensions. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, O. Cable address: "TIMROSCO".

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

Specialists in alloy steel—including hot rolled and cold finished alloy steel bars—a complete range of stainless, graphitic and standard tool analyses—and alloy and stainless seamless steel tubing.

XUM

your project "Scheduled by



Site Preparation

Footings and Foundation

Tower Setting

Scheduled by Lummus means engineering and construction is a complete integration of planning, forecasting and cost control, applied with individual responsibility from start to finish. Lummus' complete scheduling of your refinery project smooths the work flow. There is no wasted effort. You can count on delivery of an economical, well functioning plant on or before the required completion date.

Scheduled by Lummus means plant engineering starts earlier than conventional work planning. It begins with original process design and job engineering. Because time is money, the project is engineered from the start with emphasis on time-economies in the entire erection operation. Erection methods are analyzed in advance from the standpoint of practical application at the site.

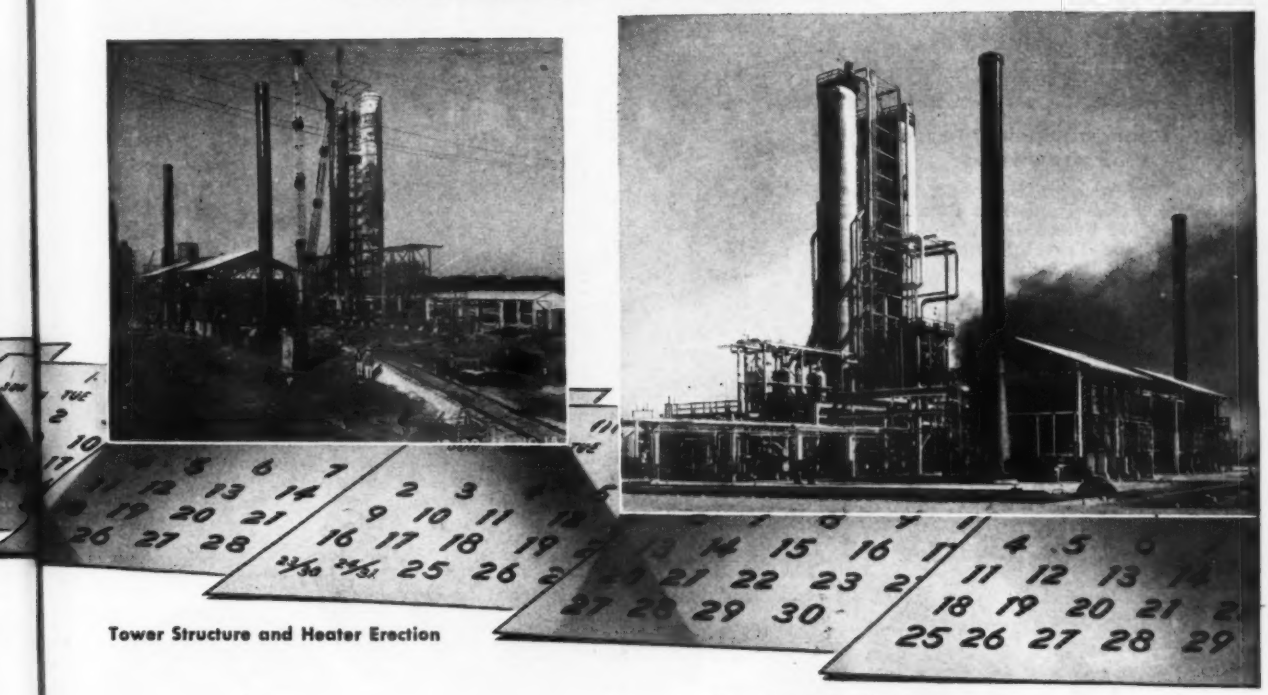
THE LUMMUS COMPANY
385 Madison Avenue, New York 17, N. Y.

LUMMUS

CHICAGO—600 South Michigan Avenue, Chicago 5, Ill.
HOUSTON—Mellie Esperson Bldg., Houston 2, Texas
The Lummus Company, Ltd., 525 Oxford St., London, W-1, England
Société Française des Techniques Lummus
39 Rue Cambon, Paris 1er, France
Compañía Anónima Venezolana Lummus—Edificio "Las Gradillas"
Esquina Las Gradillas, Caracas, Venezuela

Lummus"

means READY ON TIME



Tower Structure and Heater Erection

Start-up and Operation

Scheduled by Lummus means all materials are planned to arrive as needed. Just the construction tools and skills required for the immediate use of these materials are provided at each successive stage of the job. Costs are kept under day-to-day scrutiny and control. Problems of delivering, erecting and coordinating individual units into an operating whole are anticipated, with hundreds of previous records as a guide.

Lummus' wide range of experience is the key to this thorough and advanced method of procedure. One recent job went from letting of contracts to successful operation in eight months. Another complete foreign refinery was completed in fifteen months. Your next project, "scheduled by Lummus" can be the answer to realistic cost control and the economies that come with completion on or ahead of schedule.

PETROLEUM HORIZONS, the new 80-page book on Lummus processes and plants, features a step-by-step description and flow sheets for 31 refinery processes. It brings you complete details on the background, organization and world-wide services of the Lummus Company. Your copy available on request.

FAST – COMPACT – RUGGED

Everything you need for safe, efficient drilling has been incorporated in the new Wheland B-85 Drawworks. Console Controls can be located in the safest place on the rig floor. Driller has finger-tip, precision control over all operations—plus full visibility.

Mechanical improvements in the field tested B-85 include 750 h.p. transmission with forged steel shafts and forged steel sprockets with cut, flame hardened teeth. All drive chains and sprockets have a generous factor of safety assuring long, trouble-free operation. Precision roller bearings are used throughout. Lubrication is by pressure feed.

For a 10,000' drawworks the B-85 breaks down into surprisingly compact, easily handled loads.

Get the complete story on this new rig through your nearby Jones & Laughlin supply store or write to Tulsa for free literature.

Wheland rotary equipment to match the B-85 drawworks:

HP-14000 7 1/2 x 14, 350 h.p. Slush Pump
A-20, 20 1/2 inch Table Top Rotary
J-2500, 250 ton Crown Block
K-2500, 250 ton Traveling Block
E-6600, 350,000 lb. Swivel.

FOR DRILLING TO 10,000 FEET with 4½" drill pipe

WHELAND
B-85 DRAWWORKS
WITH CONSOLE CONTROL

Wheland Export: Lucey Export Corp., 233 Broadway, New York 7, N. Y., U. S. A. and Broad Street House, London E. C. 2, England

Jones & Laughlin Supply Company. Export: 405 Lexington Avenue, New York, New York, U. S. A.

79 stores for your convenience!

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Jones & Laughlin Supply Company

Subsidiary of Jones & Laughlin Steel Corporation

J&L STEEL

TULSA, OKLAHOMA

SOME QUICK FACTS

about the Drop Forging Service at BETHLEHEM

Here, with the answers, are some of the common questions asked our representatives by purchasers of drop forgings:

Q.—What sort of closed-die forging equipment does Bethlehem have?

A.—Steam and board drop hammers, 1500 to 8000 lb; mechanical presses to 2000 tons; upsetters 9 in. and smaller.

Q.—In what weights are Bethlehem drop forgings made?

A.—Generally speaking, up to 250 lb.

Q.—Does Bethlehem do the die-sinking?

A.—Yes—in a fine, modern, well-equipped shop.

Q.—Are both carbon and alloy steels available at Bethlehem for closed-die forgings?

A.—Yes. Just specify the type or types you want.

Q.—How about heat-treating?

A.—Every modern facility. The best metallurgical practices are followed throughout.

Q.—Can Bethlehem handle a large variety of designs?

A.—An almost endless variety. As a consequence, Bethlehem serves many different industries—automotive, petroleum, aviation, electrical, mining, and a host of others.

No doubt you have questions of your own. Why not ask a Bethlehem man for details? While he's with you, he'll be glad to review your needs and explain how Bethlehem can help you fill them advantageously.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

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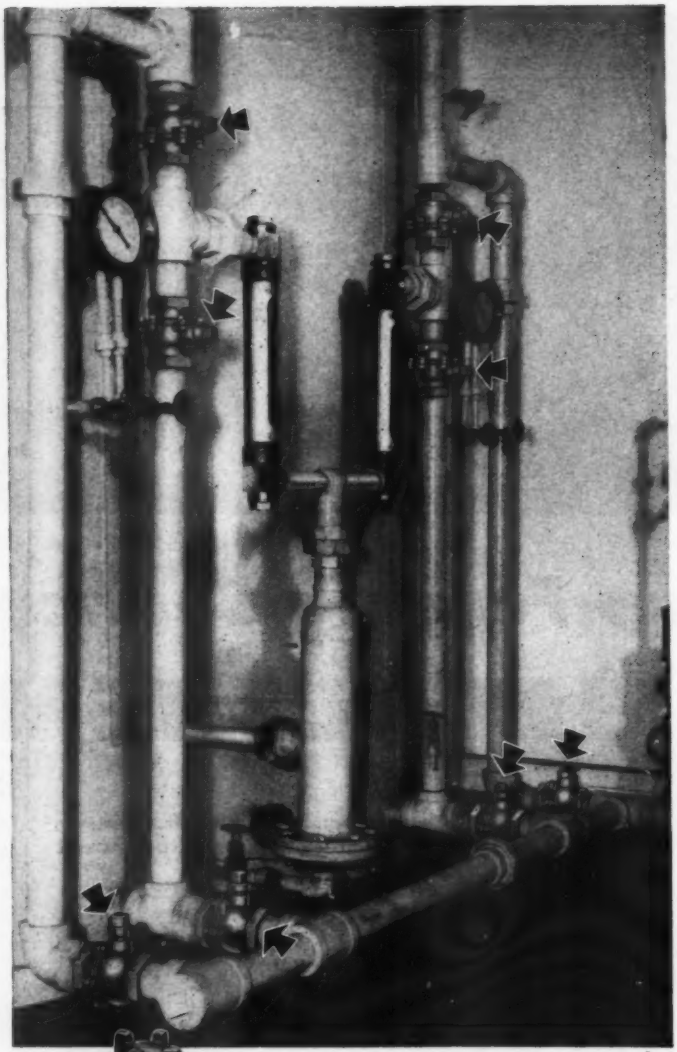


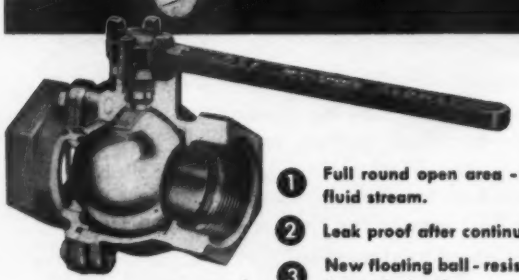
REDUCE
maintenance cost with
ROCKWOOD
BALL TYPE
VALVES

Longer service life with no maintenance is a primary advantage of the Rockwood Ball Type Valve that pays off in dollars and cents year in and year out.

The maintenance engineer of this large gas company was quickly convinced that his choice of Rockwood Valves for gasoline lines on "sweetening towers" had been sound. Says this engineer, "The full *round* flow, leak proof service, easy operation and no maintenance cost make Rockwood Valves far ahead of any competitive valve we used."

Rockwood Valves are today giving excellent performance on difficult operations in oil refineries, food, paper, chemical and rubber plants, etc. It will pay you to specify and buy Rockwood Valves. Send for bulletin V-4. Distributors in all principal cities.

Rockwood Valves are recommended for 300 p.s.i. working pressure. Made in bronze with screwed ends in all pipe sizes from ½" to 2".



... YOU'LL PROFIT EVERY DAY WITH THESE FEATURES!

1. Full round open area - no turbulence in fluid stream.
2. Leak proof after continued use.
3. New floating ball - resists pitting, scratching and abrasion.
4. No exposed seating surface in open or closed position.
5. Easy to open or close under full pressure.
6. Installed in any position.
7. Quarter turn (90°) opening and closing valve.

ROCKWOOD SPRINKLER CO

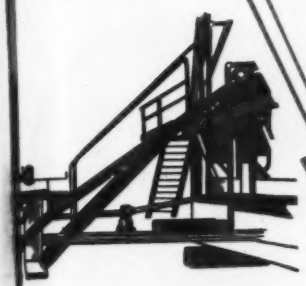
104 HARLOW STREET WORCESTER 5, MASS

Relieve the Strain with

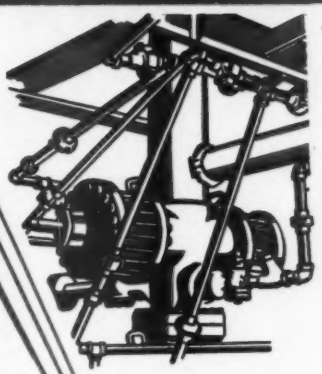
UNIBOLT FLEXI-BALL JOINTS

ROTARY HOSE—
STANDPIPE END

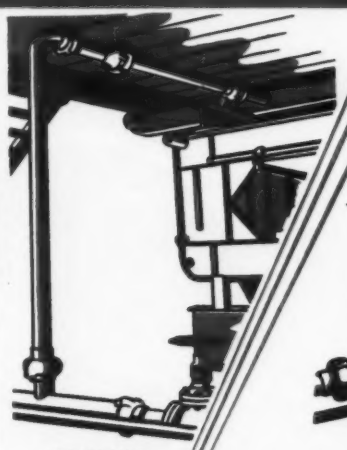
ROTARY HOSE—
SWIVEL END



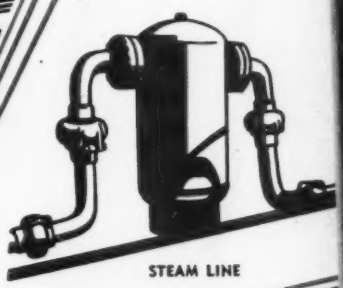
MUD LINES



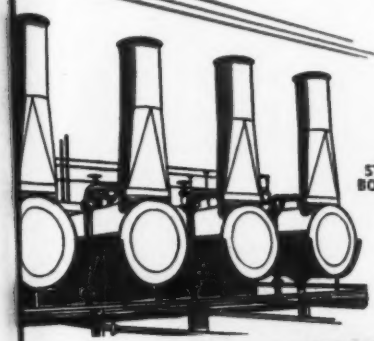
PRESSURE OPERATED
BLOWOUT PREVENTER
MANIFOLD



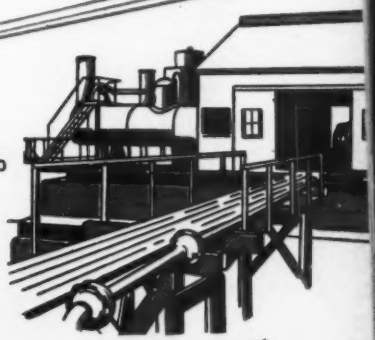
STEAM LINE
SUBJECTED TO
VIBRATION



STEAM LINE



STEAM LINE
BOILER DROPS



STEAM LINE—
BOILER BARGE TO
DRILL BARGE

The Flexi-Ball Joint, which provides for misalignment up to 38 degrees, depending on the size of the joint, is designed to relieve piping of stress caused by expansion, vibration, or misalignment. It is a "natural" for flexible manifolds.

The proven UNIBOLT coupling principle is employed to join the component parts of this fitting. As a result, trouble due to galling and freezing of threads is entirely eliminated by the Flexi-Ball design. It is assembled by the simple process of tightening one bolt with an end wrench. Even after extended periods of service, the joint can be quickly dismantled by releasing the bolt.

This fitting may be used safely in any service, since it is made in steel only. Its sizes range from 1½" to 6" and test pressures to 6000 lbs., depending on size; 500 lbs. steam working pressure.

THORNHILL-CRAVER CO.

HOUSTON, TEXAS

IT'S NO TRICK AT ALL

to get everything needed in a bridging plug

Easy to Run

Run it on wire line, on Lane-Wells conductor cable, or on tubing.

No Lost Time

Sets in seconds—no pumps needed, no waiting for cement to set.

Easy to Drill

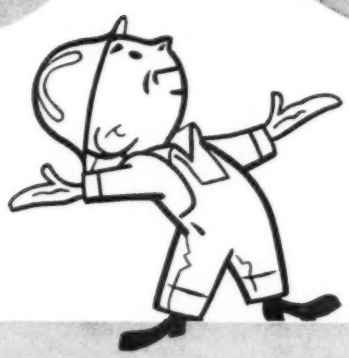
Drill it out, or knock it down, in 4 to 6 hours, with either rotary or cable tools.

Positive Pack-Off

Leakproof against differential pressures as high as 10,000 psi, at temperatures to 300° F.

Permanent

On permanent installations, the plug will outlast the casing.



AU-305

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LANE WELLS

TECHNICAL OILFIELD SERVICES

DRILLABLE BRIDGING PLUG

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General Offices, Export Office and Plant • 5610 SO. SOTO STREET, LOS ANGELES 58, CALIFORNIA

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"We do more actual well-servicing because we spend less time between jobs"

Throughout the oil industry, the trend is to use FWD for more and more jobs. It's rapidly becoming the first choice wherever conventional trucks have roughest going and shortest life — and wherever safety and schedules are vitally important.

GET FULL FACTS on the entire team of FWD's. Models now range from 14,500 to 60,000 GVW. 4- and 6-wheel-drives. Ask for the free FWD Model Book.

See your FWD distributor or Write FWD
THE FOUR WHEEL DRIVE AUTO CO.
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Canadian Factory: Kitchener, Ont.
World-Wide Sales and Service

"It's the FWD extra-traction that keeps us on schedule — over any terrain"

"Our FWD trucks last longer — because proper distribution of load and power means less strain"

"Whether my haul is over-the-highway or off-the-road — I'd rather drive an FWD"

America's Foremost Heavy-Duty Truck

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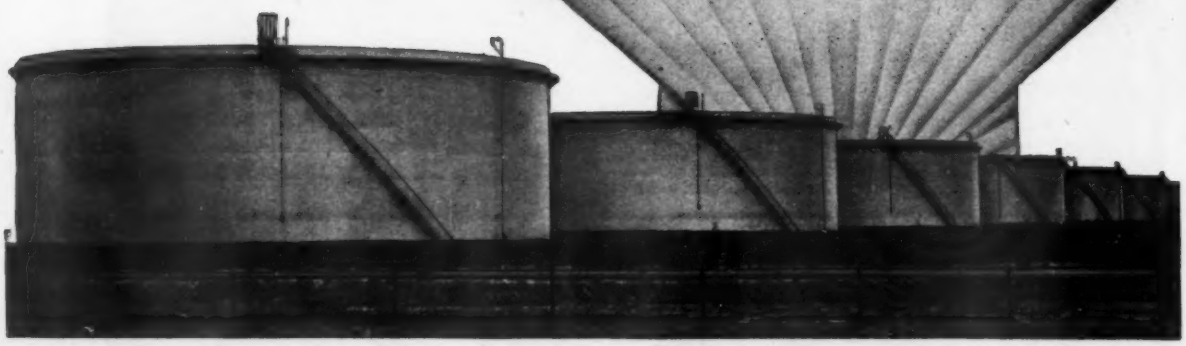
GRAVER FLOATING ROOF TANKS

at SHELL'S WOOD RIVER TANK FARM



Serving the largest American crude oil pipe line ever built by private capital

To receive the river of crude oil flowing from the mighty Basin-Ozark pipe line system, Shell has completed the Southwest Tank Farm at its Wood River Refinery.

Sprawling over 190 acres of land, this tank farm has an aggregate capacity of approximately two and one-half million barrels, involving the use of 11 Graver Double Deck Floating Roof Tanks—140 feet in diameter, 48 feet high—each with a nominal capacity of 127,000 barrels.

Thus, Graver shares in the substantial progress of the Shell Oil Company in providing facilities for reducing operating expenses and achieving greater efficiency in the handling of crudes.

One of the 11 Graver Floating Roof Tanks at Wood River. All are Double Deck Construction with the fully effective *single* Graver Seal.

FABRICATED PLATE DIVISION

GRAVER TANK & MFG. CO., INC.

EAST CHICAGO, INDIANA

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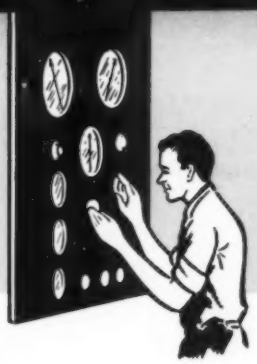
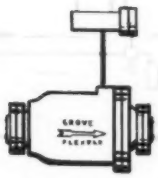


GROVE REMOTE CONTROL

PRESSURE OPERATED *flexflo* VALVES

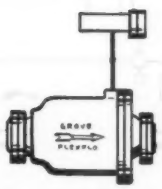


The pressure in the line does the work, opening the FlexFlo with a smooth, rolling action, or closing it with a bubble-tight seal. No manual or mechanical force is necessary in its operation. So the FlexFlo can be operated from a distance as easily and surely as if the operator were at the valve.

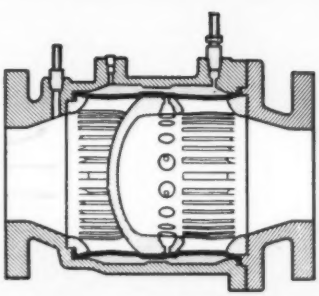
A twist of the wrist at a remote panel releases or applies pressure to the diaphragm of the control pilot mounted on the FlexFlo. This pilot uses the actual line pressure to open or close the FlexFlo with a fast, positive action.

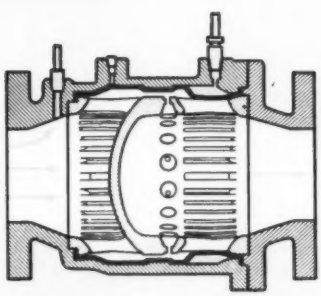
The simple FlexFlo design has been proved in more than ten years of hard service to be unequalled for dependability and long, trouble-free life in the control of air, gas, oil, water, and salt water at temperatures to 150° F. and at pressures to 1500 psi.

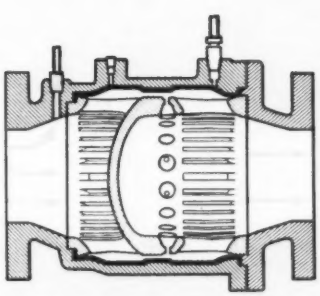
Let the Grove FlexFlo engineer show how this dependable remote control valve will increase the efficiency of your plant's operations. Write for full information.



flexflo **LETS PRESSURE DO THE WORK**







The only moving part in the Grove FlexFlo is a tough Buna N tube, which fits closely around a slotted metal core. When closed, line pressure from within, tending to force the tube off the core, is opposed by equal line pressure on the outside of the tube. Equalizing the inner and outer pressure allows the elasticity of the tube to grip tightly around the core with a positive, sealing action.

As the control pilot closes off line pressure acting on the outside of the tube, inner line pressure, being greater than the outer, begins to roll the tube off the core, opening the FlexFlo.

When pressure on the outer side of the tube is entirely removed, the inner pressure forces the tube completely off the slotted core, opening the valve wide and permitting free flow.

GROVE REGULATOR COMPANY

1901 CALUMET ST., HOUSTON 4, TEXAS • 6529 HOLLIS ST., OAKLAND, CALIF. • 3950 W. OLYMPIC BLVD., LOS ANGELES, CALIF.

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ON WELDING NECK TRANSITIONS, TESCO CASTINGS PROVIDE 3 Big Advantages

- **IMPROVED FLOW**
- **REDUCED INVENTORY**
- **REDUCED COSTS**

One of the most desirable features in a welding neck transition is a smooth, unrestricted flow from the rectangular opening through the round opening at the flange. Conversion to a Tesco steel casting not only greatly improved flow characteristics but provided these other advantages:

1. A smaller inventory in that one size casting accommodates a number of different size flanges;
2. Cost reductions as high as 60%;
3. Greatly improved appearance.

You may find that conversion of some of your parts to steel castings will result in equal if not greater advantages. Tesco maintains a product engineering department to work with your engineers in the design of new products or in redesigning old products. This service is offered without cost or obligation.

Make an appointment today for the Tesco product engineer to study your designs. We can show you countless case histories of how other manufacturers have used this Tesco service to good advantage. And you will find at Tesco every modern facility in tools and craftsmanship to produce the very highest quality steel castings for every industrial use!

TESCO IS THE MOST EXPERIENCED FOUNDRY ON THE GULF COAST

HERE'S THE WELDMENT THE TESCO CASTING REPLACED

TEXAS ELECTRIC STEEL CASTING CO.

GOOD CASTINGS — CARBON AND TESCO — HOUSTON, TEXAS

Pipe line with a future

. . . it's protected against corrosion by

BITUMASTIC ENAMELS

Steel pipe lines, carrying gas and oil underground, need long-lasting protection against corrosion. And Koppers Bitumastic® Enamels provide that protection.

Koppers Bitumastic Enamels have been *proved by performance.* Under the most severe corrosive conditions . . . in all types of soil . . . under wide variations of temperature—these protective coatings have been giving good service for 30 to 40 years. And the knowledge gained by Koppers in protecting thousands of miles of pipe lines can be of value to *your* next pipe-line job.

There are good, sound reasons for Bitumastic's lasting protection. Processed from a base of coal-tar pitch, Koppers Bitumastic Enamels are impervious to moisture. They are chemically resistant to soil elements; they do not disintegrate with age; they maintain continuously high electrical resistance. Get in touch with your Koppers representative for details.

KOPPERS BITUMASTIC ENAMELS
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KOPPERS COMPANY, INC., Tar Products Division, Dept. 803T, Pittsburgh 19, Pa.

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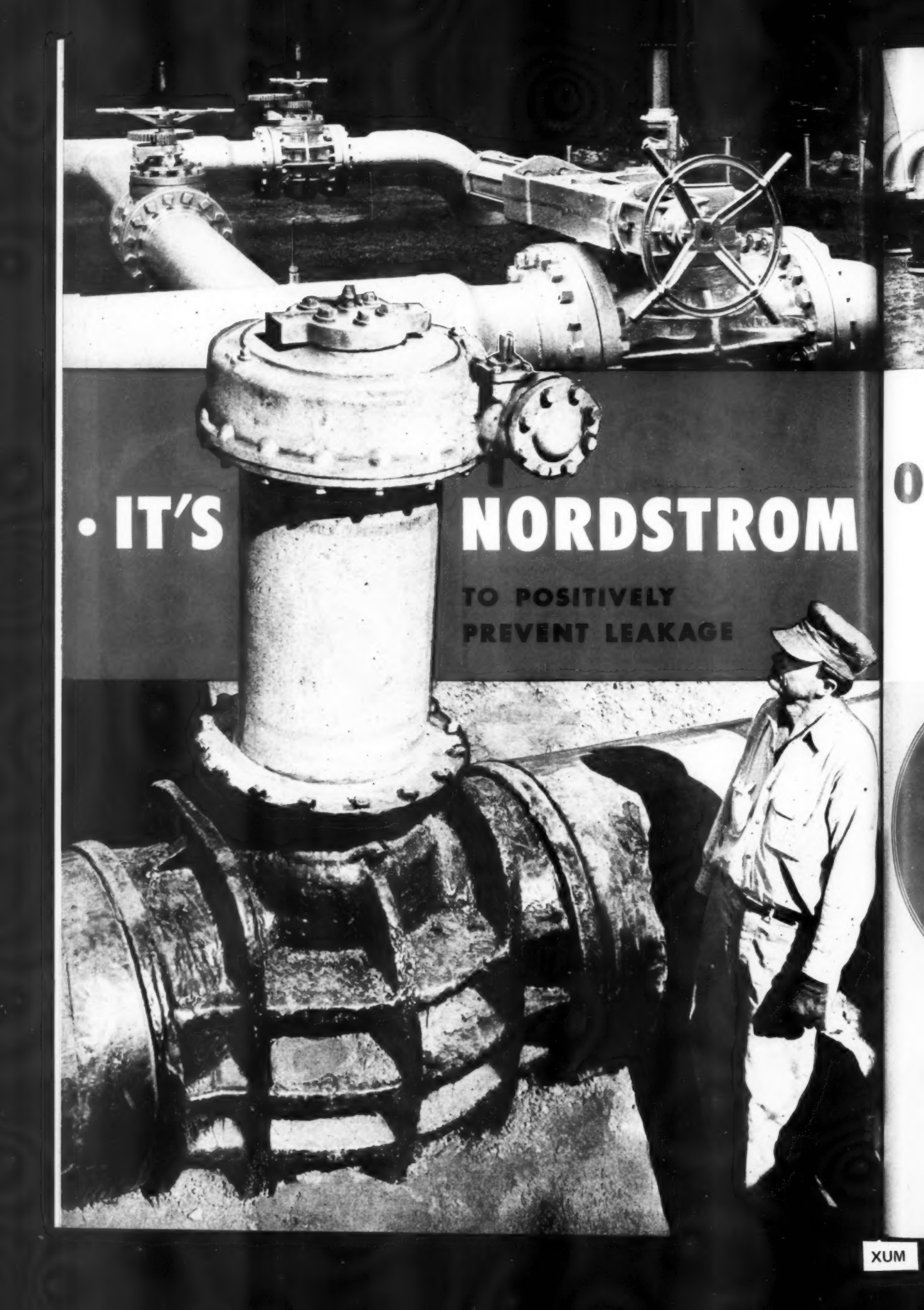
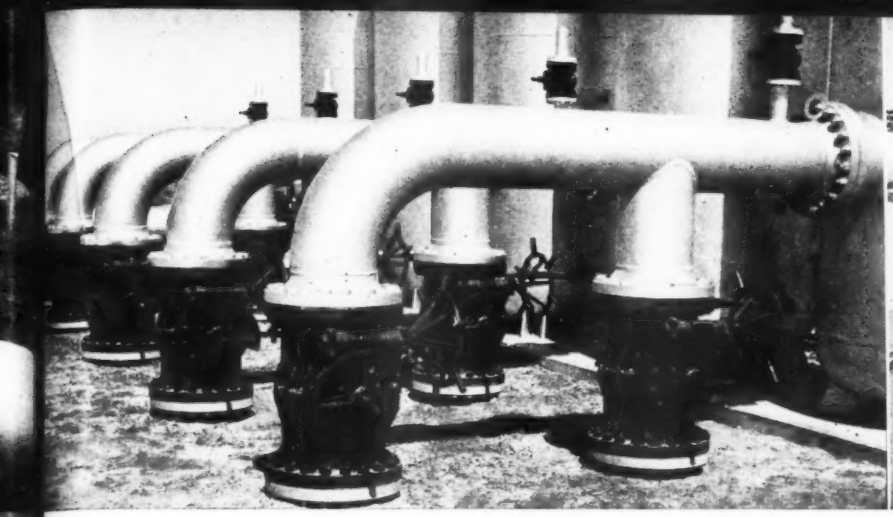
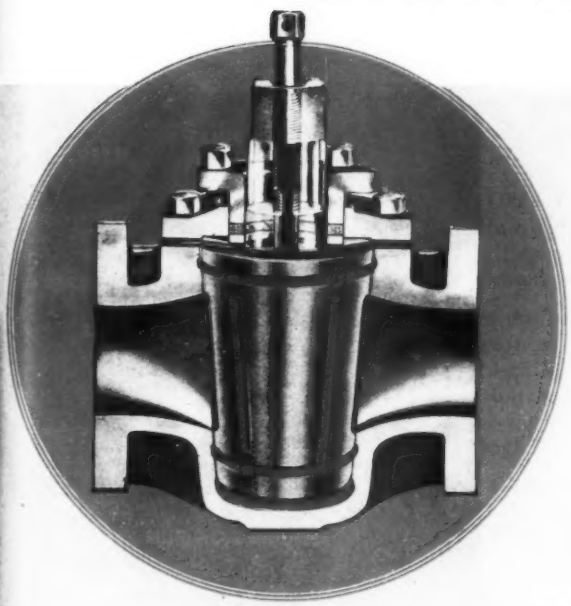

• IT'S NORDSTROM
TO POSITIVELY
PREVENT LEAKAGE



ON THE Big Lines.

NOW UP TO 34 INCH - LARGER WHEN NEEDED



The largest, the longest, the highest pressure pipe lines in America are Nordstrom-equipped. The bigger the line, the more important the valves. Nordstrom "know-how" in valve design and manufacture combine to give the best in pipe line valve performance—*positive shut-off, quick emergency closing, compactness, ruggedness, reliability.*

In large high pressure lines, Nordstrom valves operate positively and with much less effort than any other type. Compare the number of turns required—the time required—to open or close a "Big Inch" pipe line valve under full differential pressure.

A full range of pipe line accessories—operating extensions for buried valves; pneumatic or electric power operators; automatic or remote controls; position indicators.

Automatic lubrication with HYPERMATIC greatly reduces maintenance—greatly increases valve efficiency.

Ask FOR PIPE LINE BULLETIN

A 168-page presentation, specially edited for Pipe Line Engineers. Includes more than 100 interesting installation views, pipe line maps, valve controls, pipe line data, etc. Ask for Bulletin V-210.

Nordstrom Valves

NOW AUTOMATICALLY LUBRICATED WITH

PATENTS APPLIED FOR

Hypermatic

TRADE MARK

ROCKWELL MANUFACTURING COMPANY

400 North Lexington Avenue, Pittsburgh 8, Pa., Offices in all principal cities

ROCKWELL

Export — Rockwell Mfg. Co., International Division, Empire State Building, New York 1

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VARIETY

is not the spice of life here but it

Permits Piping Improvement

Midwest offers a large variety of welding fittings to help you improve *your* piping. Many of these fittings were originated by Midwest for the purpose.

For example, the Midwest Reducing Elbow saves a third of the welding, decreases turbulence and pressure drop and improves appearance when used instead of a standard elbow and reducer. Midwest Long Tangent Elbows have a tangent or straight section at each end equal to ¼ the nominal pipe size; this saves pipe, saves time in lining up, and often saves welding. (These are in addition to ASA Type and Short Radius Elbows.) Midwest Sleeves relieve the line butt weld of all bending stress and much of the tensile stress. Midwest Saddles restore the original pipe strength and reinforce the joint.

Use of Midwest Welding Fittings assures maximum improvement and economy in piping. For your welding fitting needs, get in touch with the Midwest Distributor near you.

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PIPING & SUPPLY COMPANY, Inc.

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MIDWEST WELDING FITTINGS Improve Piping Designs and Reduce Costs

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Take an Idea

ON A NEW USE FOR A JET

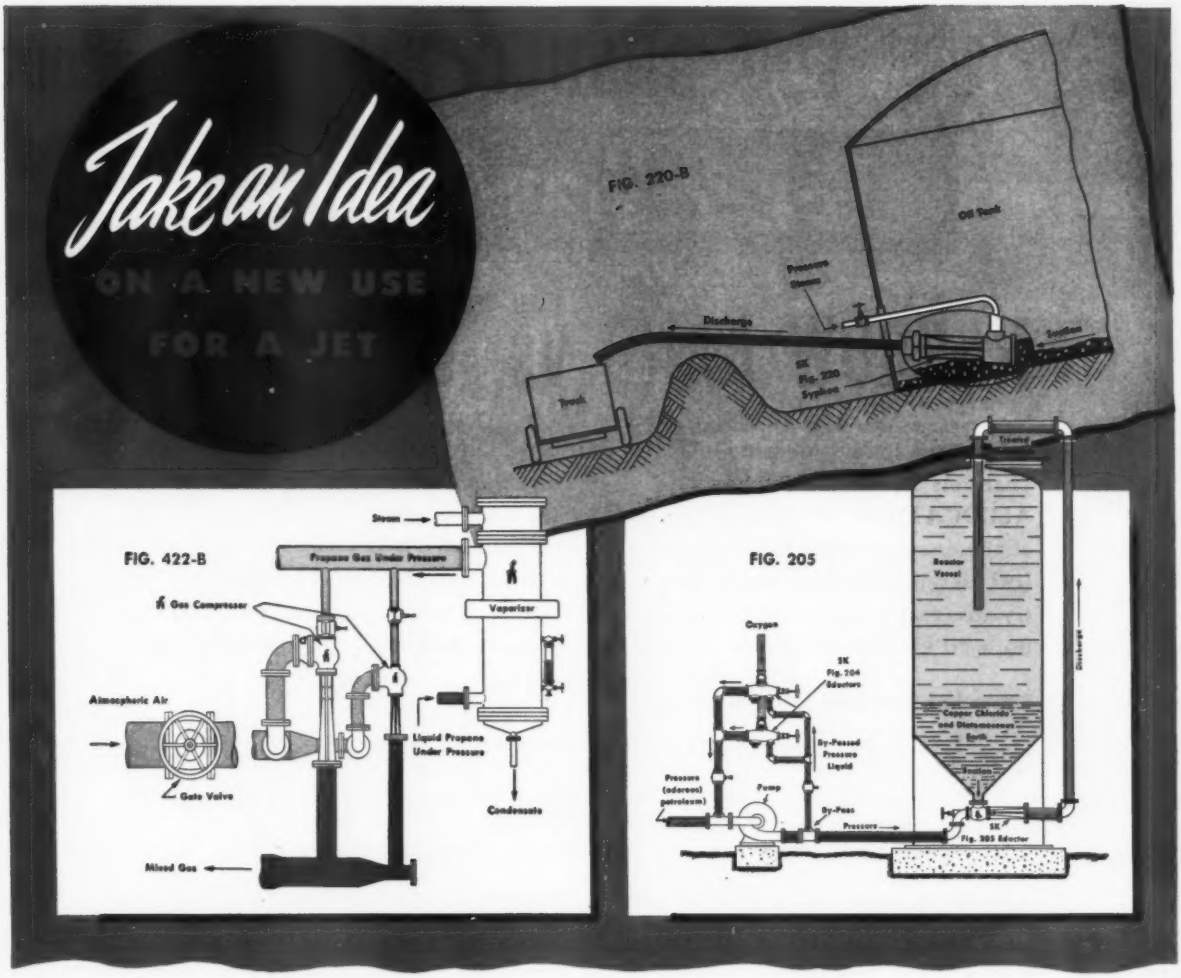

FIG. 220-B. In this application, an SK Fig. 220 Steam Jet Syphon is used to clean sludge from the bottom of an oil tank.

FIG. 422-B. Two SK Gas Jet Compressors are used to mix propane gas under pressure with atmospheric air. Variations in capacity and the proportion of the mixture can be closely controlled.

FIG. 205. In this application two SK Fig. 204 Water Jet Eductors and an SK Fig. 205 Eductor are being used in a process designed to convert malodorous compounds in petroleum products into compounds with a marketable odor.

TURN it over to SK engineers and watch it develop—in most cases, into an economic method of doing a job better and faster with SK *"Job Engineered"* Jet Apparatus. That's how the applications you see illustrated above came about.

Over the years, many petroleum engineers have come to SK for the solution to some producing, transporting, gas processing, or refining problem. Working with these engineers, and solving the many problems encountered, has given SK employees a wealth of engineering knowledge involving the use of all types of Jet Apparatus from Steam Jet Injectors, through Water Jet Eductors, Jet Primers and Exhausters to Fume Scrubbers.

We CAN help YOU with your problem by recommending a standard product, designing a new model or, if an engineering analysis indicates that Jet Apparatus cannot meet your requirements, by frankly informing you of the facts and recommending some other type of equipment.

To give you some idea of the equipment available, we offer our Folder of Jet Apparatus. Send for it.

Representatives in: Atlanta, Baltimore, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Denver, Detroit, Houston, Indianapolis, Kansas City, Los Angeles, Memphis, New Orleans, New York, Philadelphia, Pittsburgh, Portland, St. Louis, St. Paul, San Francisco, Seattle, Tulsa, Montreal and Toronto, Canada.

SCHUTTE and KOERTING Company

Manufacturing Engineers

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FACTS YOU SHOULD KNOW . . . about

G-E 2-Way Radio

NARROW BAND vs. WIDE BAND

• Narrow band equipment (20 kc channels in the 25-50 mc band) is ALLOCATION INSURANCE. It is almost inevitable that future geographical assignment plans made by industry advisory groups will be drawn up on a 20 kc channel separation basis. Installation of 20 kc equipment NOW protects your system against interference from same-area stations 40 kc off your own frequency and from skip signals only 20 kc removed from your channel. It would be to your advantage to consider a change-over now.

Extended field and lab tests show:

1. There is no discernible difference in communication range between 20 kc and 40 kc systems.
2. Lower multiplication factor in 20 kc transmitters means substantial reduction of spurious radiations.
3. Signal-to-noise ratio differences in high signal level areas are insignificant.

• You'll find more true, high-selectivity General Electric 20 kc units in service than all other makes combined. And G. E. also manufactures high-performance units for expansion of present systems where continued operation on a 40 kc channel basis is desired.

Instant communication for wide-area operations is our specialty. There's a radio communication representative at the G-E office near you. Ask him for full details. Meanwhile, write for some interesting new literature on microwave equipment: General Electric Company, Section 880-24, Electronics Park, Syracuse, New York.

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The tanks shown here are ample proof. Part of an oil refinery's acid plant, they are well into their second year of enduring protection by such coatings—despite overflow of sulphuric acid and sodium hydroxide—despite exposure to sulphur dioxide—despite exposure to salt air and corrosive fumes.

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RELIABILITY

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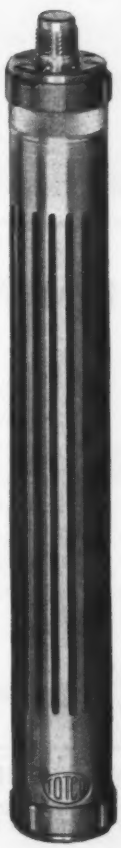

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Dropped down drill pipe; picked up with core barrel overshot.

Dropped down drill pipe; recovered when bit is changed.

Run in the Recorder connected to a core barrel overshot when picking up a retractable core barrel.

Run in and out on ordinary sand line.

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Technical Oil Tool Corp., Ltd.
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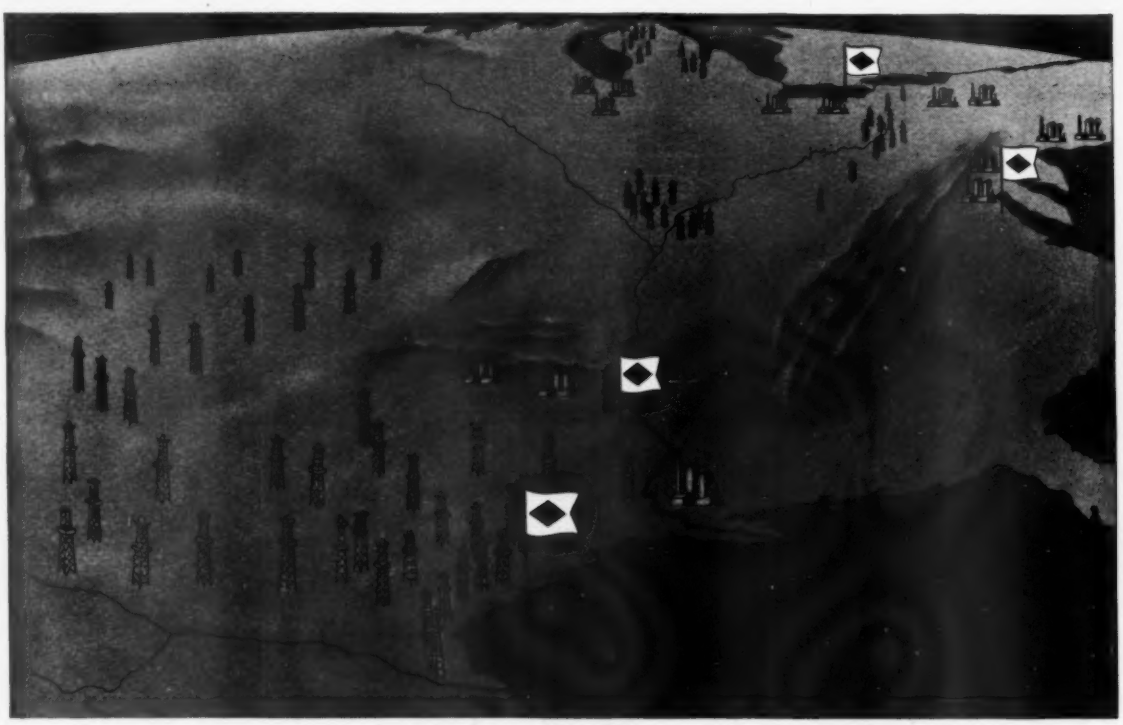

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It takes a steady flow of caustic soda and chlorine to fill the growing needs of the oil industry's production and refining activities. And—from the Southwest to the Atlantic—DIAMOND ALKALI's string of chlorine-caustic soda plants fits your industry's operation like a glove. This means dependability of supply, speedy shipments and a service geared to your needs.

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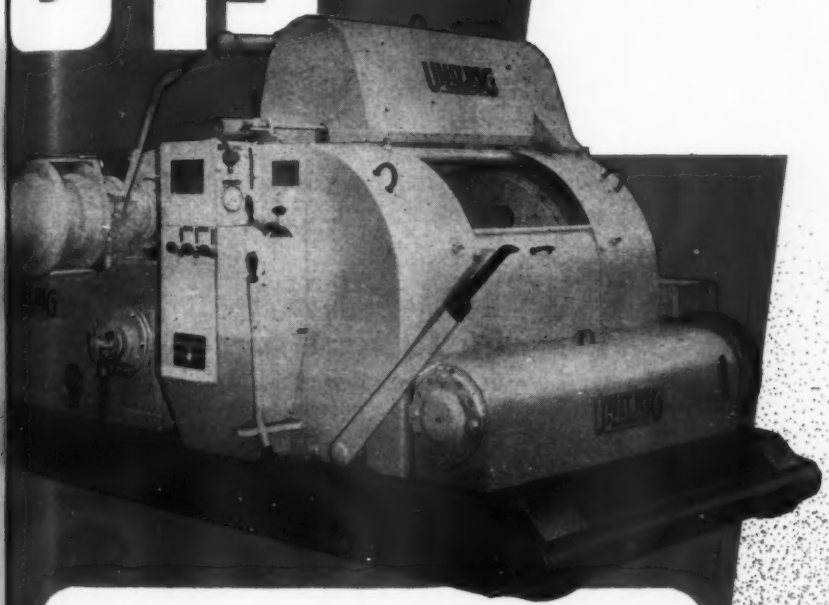

4

service

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All Unit Rig models are designed so they can easily be moved on or off a location in a hurry. The "bugs" are taken out in tests run at the factory before any unit leaves, so you can depend upon Unit Rig for trouble-free service at the lowest possible cost. For drilling deep or shallow wells . . . you'll find a Unit Rig model that's designed for the job.

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POPULARITY LEADERS Chevrolet trucks are the favorites by far! In every postwar year truck users have bought more Chevrolets than any other make. And that's proof of the owner satisfaction they have earned!

PERFORMANCE LEADERS Chevrolet trucks give you high pulling power over a wide range of usable road speeds . . . cut down total trip time with high acceleration on the straightaway.

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PRICE LEADERS You're money ahead with Chevrolet trucks! Chevrolet's rock-bottom initial cost—outstandingly low cost of operation and upkeep—high-trade-in value, all add up to the lowest price for you.

Packed with VALUE... *Primed with* POWER

Chevrolet Advance-Design trucks have everything it takes —and plenty to spare. Rugged construction to withstand the wear and tear. Handling ease and comfort to lighten the load of a day's work. And more power than ever! Two great Valve-in-Head engines—the Loadmaster 105 h.p. and the Thriftmaster 92 h.p.—make these the most powerful trucks Chevrolet has built! Yes, these new jobs bring you peak value—and at a low price. They cost surprisingly little to buy, to run and maintain. That's why Chevrolet trucks outsell them all!

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AHEAD WITH ALL THESE PLUS VALUES

• TWO GREAT VALVE-IN-HEAD ENGINES: the New 105-h.p. Loadmaster and the Improved 92-h.p. Thriftmaster—to give you greater power per gallon, lower cost per load • THE NEW POWER-JET CARBURETOR: smoother, quicker acceleration response • DIAPHRAGM SPRING CLUTCH for easy action engagement • SYNCHRO-MESH TRANSMISSIONS for fast, smooth shifting • HYPOID REAR AXLES—5 times more durable than spiral bevel type • DOUBLE-ARTICULATED BRAKES—for complete driver control • WIDE-BASE WHEELS for increased tire mileage • ADVANCE-DESIGN STYLING with the "Cab that Breathes" • BALL-TYPE STEERING for easier handling • UNIT-DESIGN BODIES—precision built.

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DEPENDABLE RUGGEDNESS
Bull Dog Industrial V-Belts are available in A, B, C, D and E sections, full range of lengths
Fractional Horsepower (FHP) V-Belts are available in three standard sections, full range of lengths

LESS SLIPPAGE! COOLER RUNNING! LONGER LASTING!

NO WONDER THERE'S INCREASING DEMAND FOR

RUGGED BULL DOG V-BELTS

On hard-hitting oil field jobs, new Bull Dog V-Belts are making records to be proud of. Because these belts have proved they deliver steady, trouble-free service that speeds production and slashes maintenance costs, operators are specifying them on pumping units, drilling rig drives and other heavy duty installations.

Here's why there's less slippage with Bull Dog V-Belts, fewer shutdowns for adjustments, greater long-term economy in their use:

1. *Exclusive Bull Dog Cord Section Has Higher Tensile Strength,* able to carry the load and absorb shock.

2. *Low Stretch,* because exclusive Bull Dog Cords are processed in a new way. As a result, there's less slippage, fewer adjustments, longer belt life.

3. *Cool Running,* thanks to quality-controlled compounds developed in BWH laboratories, which do not crack or deteriorate under the most severe flexing.

4. *Wear-Resistant Covers* of heavy, bias-cut fabric, to protect heart of belt from dirt, grease and moisture.

Bull Dog V-Belts are one of many famous products manufactured by BWH. When you need industrial rubber goods, look to BWH for products of dependable ruggedness, to BWH distributors for dependable service.

HAVE YOU A JOB WHERE STAMINA COUNTS?

Bring us your toughest problems. We're specialists in solving them. Consult the Happy Company, Tulsa, Oklahoma, or write to us direct.

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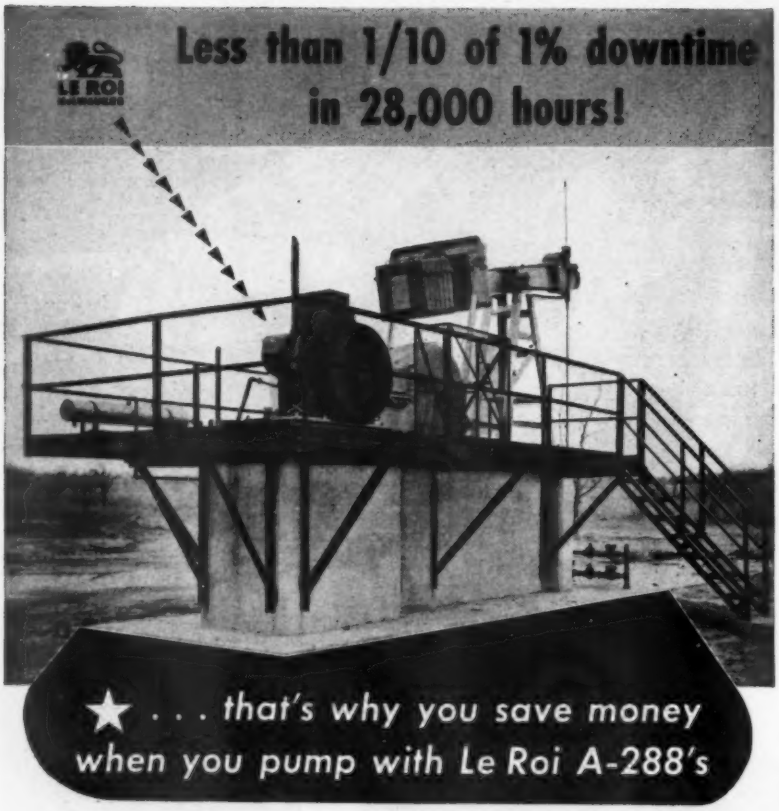

FOR more than 3 years of continuous-duty service, this Le Roi A-288 required little more than routine inspection every other week. Oil is changed every 2000 hours. And because of the patented, closed "vaporizing-condensing" cooling system, make-up water is negligible. Furthermore, inspection requires only a few minutes time because of visible oil and water gauges — *shut down is unnecessary.*

Such performance is typical. So get after your pumping costs with Le Roi A-288's. Horsepowers range from 13 to 26, and speeds from 360 to 720 rpm. Have your Le Roi distributor show you how you can save money. Write for detailed information.

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P-102

See your LE ROI MILWAUKEE *Distributor*

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Complete Sales and Service Facilities

They Say—

First Problem

"The Eleventh Hour is here for business to speak for itself. Now and from now on, the men who run American business must devote as much—if not more—time and effort to the public relations of their business as they spend on finance, production, and distribution. Unless they do, they will not need to worry about the latter problems. Government will be glad to handle them all."

Harry E. Humphreys, president, United States Rubber Co.

Demonstrating Ability

"It is my personal opinion that the petroleum industry can and will meet the demands that may be placed upon it in the months ahead. I believe the industry is now demonstrating that ability in terms of increased output and increasing total inventories of crude oil and its products. As we all know, a continuous and aggressive exploration and development program to make available additional reserves is the only method by which the industry's capacity can be maintained and expanded."

Harold B. Fell, chairman of the economics committee, Independent Petroleum Association of America, in report to Interstate Oil Compact Commission.

Oil for War

"Competent opinion is to the effect that the United States could fulfill its wartime essential needs for liquid fuels. Obviously, top priorities would be granted to the fighting services. Lesser priorities would go for the necessary industrial uses, such as transportation, shipping, and the like. The civilian public would get what was left, and in the event of a major conflict there might be severe gasoline rationing. Moreover, the civilian would have to use degraded gasoline in his car, and might have difficulty in procuring enough fuel oil for home heating.

"Of foremost importance is the apparent belief that crude oil reserves within the Western Hemisphere are adequate. . . . Oil-refining capacity, however, might be hard pressed to fulfill specialized portions of the great demands of a wartime economy. . . . Perhaps much new refining equipment used in ultramodern practice might have to be installed, but in general the petroleum industry is in a far better condition of readiness than it was—along with other industries—in the early phase of World War II. Moreover, the oil industry today has the experience for supply-

ing the fighting services with the qualities, types, and amounts wanted."

Bulletin of Guaranty Trust Co., New York.

Likes "Costimating"

Gentlemen:

. . . I have found the "Costimating" series especially interesting and beneficial in my own work which is primarily engineering and estimating new construction work, and would very much like to purchase four bound copies of this series for myself and other members of my department. . . .

Very truly yours,
Floyd J. Messner, Long Beach, Calif.

Lifeblood of Civilization

"As industries go, the petroleum industry is young. Yet, in the 91 years since its discovery at Titusville, Pa., its products have become the lifeblood of civilization—just as steel is the backbone.

"Today, oil supplies the power for the wheels, wings, and industries of a modern America. With natural gas, it provides more than half the energy requirements of the nation.

"Currently in this country there are almost 450,000 wells. From these come roughly two billion barrels of crude each year. Despite this huge production, however, the proved reserves of crude and other liquid hydrocarbons are at the highest point in history.

"To meet the demands for refined products, refinery capacity has risen steadily throughout the years. It now stands at 6.6 million barrels per day —an all-time high and a testimonial to the foresight of oil men. Many of these huge refinery units cost millions of dollars, and so swift and variable are technical advances that sometimes equipment is outdated before it is ever placed in use.

"All that, it seems to us, speaks well for the oil industry's productive efficiency — efficiency which has resulted in more oil for more people at prices within the reach of everyone."

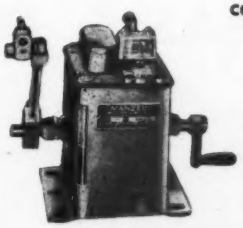
Gulf Oil Corp. midyear report to stockholders.

Fortunate Competition

"It is fortunate for our nation that the oil industry is a competitive industry. At the conclusion of World War II, as material began to become more available, the drilling of wells each year set a new record in both the number of wells drilled and total footage drilled. Each company has tried to enlarge its reserve and its daily allowed production. Without the competition between companies in the industry, the nation today would be without the enormous increased reserves that have been developed. The search for new oil is

Force Feed Lubricators

Many Manufacturers serving the petroleum industry standardize on Manzel Force Feed Lubricators. Manzels supply all wearing parts with just enough lubricating oil . . . cut labor costs . . . reduce oil consumption . . . prevent costly breakdowns.



Model 25
Double Plunger Type. One to thirty feeds. Each feed adjustable, from fraction of a drop to 13 drops per stroke.

Model 94
Liquid Sight Feed Type. Suitable for pressures up to 3,000 lbs. Handles oil of any viscosity, delivering it at regular intervals.

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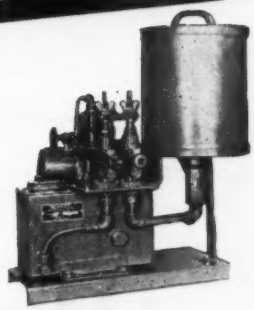
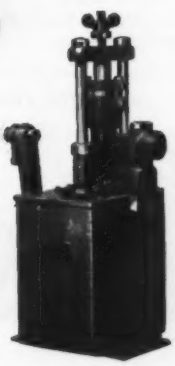
Sturdily built and simply designed, Manzel feeders have an unsurpassed record for dependable, trouble-free operation.



Series 60T
Simple, sturdy, single plunger pump with patented piston valve which is highly efficient for handling heavy chemicals.

NEW CORROSION RESISTANT MODEL 47TX
A cone valve type feeder for handling heavy or light chemicals. Reciprocating or rotary gas drive motor is automatically self-lubricated to resist corrosion.



Series 80T
Built on the same principle as the series "60" but larger and heavier. Handles chemicals in much greater quantities.

Be sure to specify Manzel on your next installation . . . and write for helpful information about obtaining Manzels for your present equipment.

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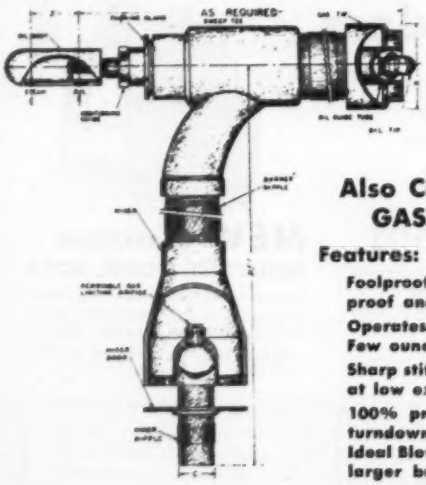
JOHN ZINK JZ SERIES Y and YC

COMBINATION GAS & OIL BURNERS

John Zink Series "ST"



Auxiliary GAS BURNER

Also Combination GAS and OIL

Features:

- Foolproof, Windproof, Rainproof and Blowout proof.
- Operates on all pressures: Few ounces to 50 lbs.
- Sharp stiff cylindrical flames at low excess air.
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John Zink Series Y and YC Combination Gas and Oil Burners are particularly designed for boilers and process furnaces where maximum heat release at low excess air and high heat density place a premium on reliable burner performance at low first cost.

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- RUGGED WEATHER-PROOF CONSTRUCTION
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continuous, with exploratory crews attempting to find new oil for their companies before it is found by their competitors. . .

"Natural gas is available today in much greater abundance, and in many more places, than during the second World War and even with all of the construction of pipe lines that has taken place during the last 5 years, the reserves of natural gas have increased to an all-time high in excess of 180 trillion cubic feet. These reserves, like oil, have shown a continued increase from year to year. Given the same incentive that the oil industry has had in the past, the control of production and gathering of natural gas left exclusively with the state regulatory authorities, the oil industry will continue to find, and make available for the consuming areas, a plentiful supply of natural gas in the future."

Gov. Roy J. Turner of Oklahoma, reporting as chairman of the Interstate Oil Compact Commission.

Basis of Greatness

"The economic greatness of the United States was not built in legislative halls. It was not established by government decree. It was not created by the decisions of our high courts.

"The men who contributed most to the economic strength of our country were not hampered by an army of bureaucrats pretending to look after their interests. They were not controlled by government directives and regulations designed to serve political purposes. They did not encounter government competition with private industry."

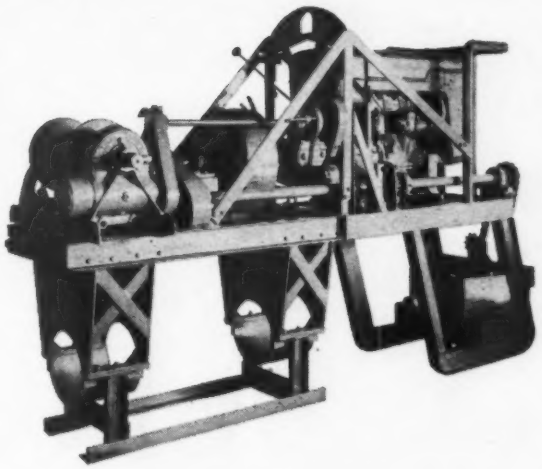
Sen. Edward Martin (Pa.)

"Do Unto Others—"

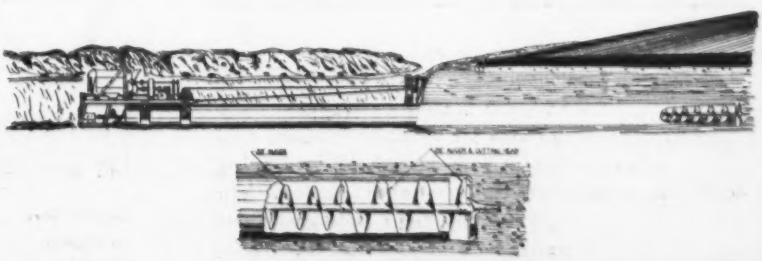
"If we are to be well thought of by our customers and the general public, it will be brought about by the deeds and actions of everyone connected with the company, for every man and woman connected with Monsanto represents the company in the eyes of his family and friends.

"The company is judged by the actions of these people who operate and work in it. Too many people feel that corporate public relations is a mystery. Actually it is quite simple and consists merely of having the group as a whole observe the same simple rule which applies to personalities, 'Do unto others as you would have done unto yourself.' It consists of being courteous without fawning; thoughtful about others without being paternalistic; straightforward without being overbearing; and friendly to all groups and individuals who deserve friendship."

William M. Rand, president, Monsanto Chemical Co., speaking in St. Louis when he accepted an Achievement Award for his company in the field of public relations.



CROSE AUGER TYPE ROAD BORING MACHINE installs pipe casing up to and including 34″ in diameter. This machine has proven highly satisfactory with Pipe Line Contractors for the fastest method of installing pipe casing where rock is not encountered. Machines for installing casing larger than 34″ in diameter are also available.



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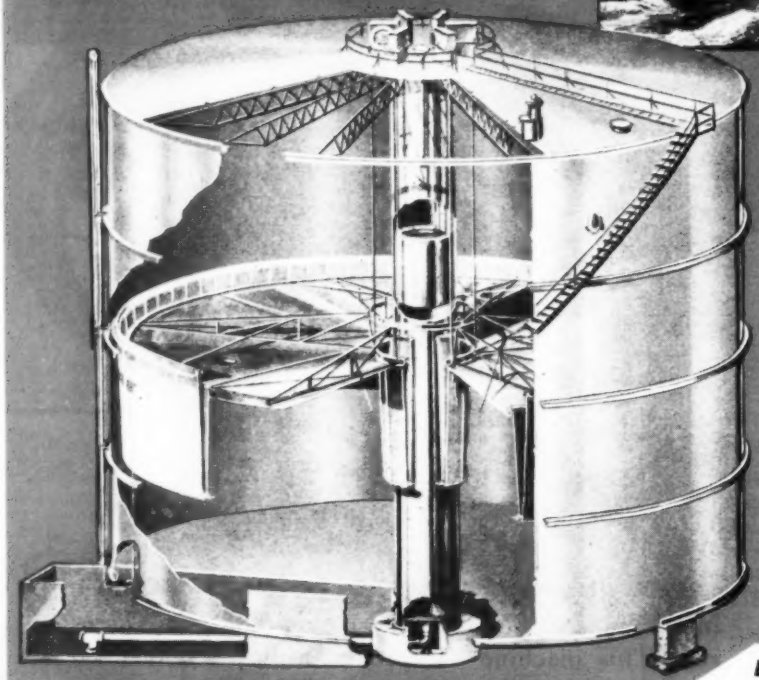
DRY SEAL Gasholder

CONVERTS BREATHING AND PUMPING LOSSES INTO PROFITS



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100% DRY SEAL
No wet seal corrosion problems— no heating—no fire hazard

VAPOR BALANCING AT STANDARD CONE ROOF PRESSURE

ALL MOVING PARTS UNDER COVER

EASY ACCESS FOR INSPECTION DURING OPERATION

THE DRY SEAL GASHOLDER VAPOR BALANCING SYSTEM

The more it works—the more you save!
One typical gasoline refinery interconnected a 150,000 cubic foot Wiggins DRY SEAL Gasholder with six 25,000 bbl. cone roof tanks. In one week, breathing and pumping losses of 5,220 gallons were saved. In less than 20 months, the whole gasholder installation was paid for (including 5% interest, depreciation, taxes, insurance, maintenance and operating).
Ask for a "Pay Out Analysis" of your storage tankage without obligation. And be sure to write for Bulletin VB10, too.

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Waiting Line

YOU may not realize how lucky you are to be a member of the select group which gets to read our favorite oil publication. We don't sell it to any Tom, Dick, and Harry, you know; only to those actually engaged in the oil business.

Once in a great while our soft-hearted circulation manager may break down under a particularly plaintive plea and sell it (at the single-copy price of 50 cents per issue) to someone who says he just has to have it in his business even though his business isn't strictly oil. Here's a sample of the kind that wears him down:

"Really, the Journal is a very interesting publication, but it is worth one's life to obtain a copy of it here. Of all the branches the New York Public Library has, it can be borrowed for 30 minutes only at the main 42nd Street Branch. There is always a waiting list and there are also times when I have the foresight to reserve it in advance, but it always happens that someone else has reserved it for the next 30 minutes. Needless to say, though I am a very fast reader there is always someone waiting for me to surrender it."

There's a man who really appreciates a good magazine.

The Best People

THROUGH these pages pore the best people in the world—our subscribers.

We have had plenty of proof, through the years, that our readers were the best people in the petroleum industry (and that means best in the world, doesn't it?), but until recently we never nailed down that fact with statistical finality. Now our market research department is in the process of accomplishing that feat.

It is in the final stages of what, for want of a better term, it calls a census of the oil and gas industry. By dint of a lot of traveling, interviewing, and questionnairing it is compiling its own Who's Who of our industry. The finished product will contain no biographical sketches but it will show how many people there are, and who and what and where they are, who really keep this oil industry ticking, the people who make the decisions, who spend the money, who do the job.

The first chapter off the press is on rotary-drilling contractors, and it has some revealing information about who drills the wells. You may have a copy for the asking, and the other chapters, too, as they come along in the next few weeks.

This research project, as you may divine, was not undertaken solely as a contribution to the knowledge of the nations. As the results of the census come in, our advertising men compare them with our subscription list, and the results cause them to smile out loud.

This led them to invent a "Three R's" of their own: Right Readers Read. This snappy little slogan doesn't come right out and say exactly what petroleum publication the right readers read, but you don't have to be very smart to deduce that it's what you're reading right now. And if you are a potential advertiser, one of our boys will be around real soon to remove any doubts.

Too-Portable Rig

WE thought we had seen everything in the classified section of our favorite oil publication, but last week there was something new: An offer of a liberal reward for information leading to the recovery of a drilling rig mysteriously missing from a location near Las Cruces, N. M.

We could consider it a reflection on the righteousness of our subscribers to imply that any of them might consort with rig thieves, but we prefer to view it as a tribute to the wide readership of the Big Yellow Book. We knew that the possibility of war has caused fears of a shortage of drilling equipment, but we regret to see that it has led to outright hijacking. The trend toward easy portability of rigs appears to have gone too far.

—Henry D. Ralph

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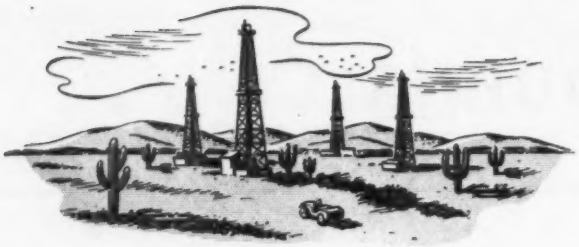

NICKEL-MOLYBDENUM CAST IRON provides essential strength, wear-resistance and pressure-tightness in cast components of this Figure 7024 Wheatley Power Pump, produced by Frank Wheatley Pump & Valve Mfr., of Tulsa, Okla. With 2½‴ liners, this unit delivers 657 b.p.d. against pressures ranging up to 1190 p.s.i. With 4" liners, it delivers 3009 b.p.d. against pressures up to 450 p.s.i. These capacities are based on a crankshaft r.p.m. of 70, but the unit will run efficiently at 100 r.p.m. with a corresponding volume increase.

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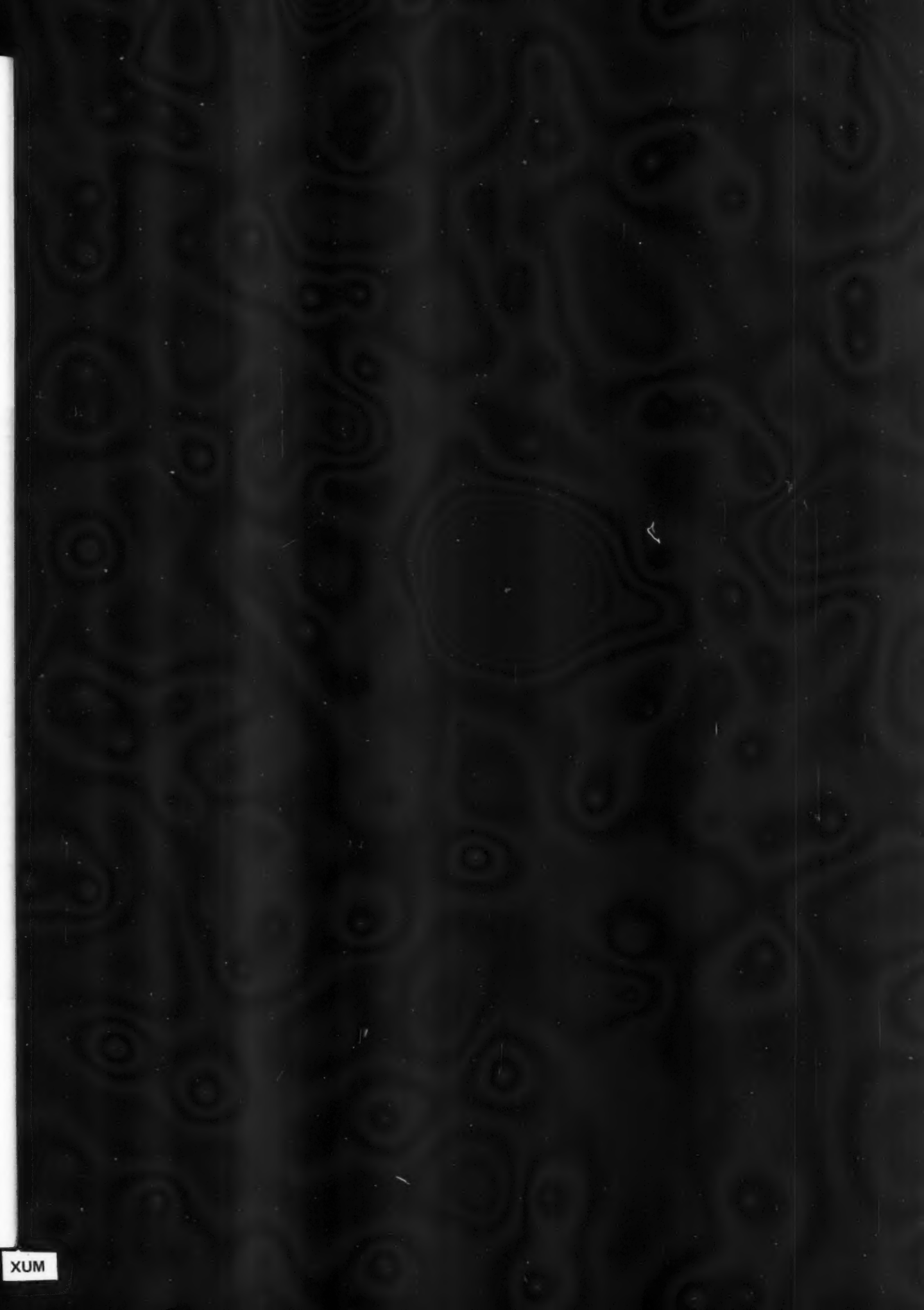
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Paramount Right

Foreigners have great difficulty understanding our federal form of government. The jealousies, conflicting jurisdictions, and struggles for power don't make sense to them. Sometimes they don't make sense to us either.

A case in point is offshore oil. For years the states leased the tidelands, the oil companies operated them, and the general public used the oil. Then, 3 years ago, the Supreme Court said the federal Government has paramount rights offshore. These rights were not defined.

For 3 years Congress has been trying, without success, to write a law defining "paramount rights" and delineating the jurisdictions of federal and state governments. The states say the federal Government is claiming more than the court intended, and the federal Government counters with the same charge against the states. Since both sides appear to be about evenly matched, this deadlock could go on for years more.

Meanwhile the offshore operators are right in the big middle. The public has been getting the oil because the operators have continued to produce in the belief that their new landlord will validate their leases. But further development is virtually halted because no one knows who has the right to grant new leases.

This would be funny if it were not so serious. But now the international situation suggests that we may soon need all the oil we can get, onshore or offshore. This necessity should take precedence over the question of what pocket the royalties will go into when oil is produced.

In general the offshore operators don't care much who their landlord is so long as they get fair treatment and a reasonable chance to recoup their very heavy investments. But recent events in Washington suggest that the federal Government may not validate their leases if it succeeds in getting full control, and might even shut down operations.

This is bad. It is bad for the companies because they may lose their investments, and therefore they are not likely to do any more offshore work. It is bad for the public because offshore production may decline. It is bad for both state and federal governments because there will be smaller royalties to fight over.

At this point the oil industry might well attempt to break the deadlock by coming forward with a realistic, workable plan, objectively drawn, for getting out the oil for the nation's present need, a plan which would protect present investments and encourage more. Getting out the oil is all that really matters. That takes money and know-how, and the industry is ready and able to provide both, just as it does onshore.

Let the various governments fight until doomsday over dividing up the royalties. The only paramount right in offshore oil is the nation's right to have the use of the oil when it needs it.

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THIS WEEK

WASHINGTON—Control legislation slowly takes shape in Congress, giving the President broad powers. . . . ¶Executive agencies fight to administer the controls when voted. . . . It looks like Interior will handle petroleum problems and be claimant agency to Commerce for oil's steel. . . . ¶House committee begins investigation of capacity to produce aviation gasoline and synthetic rubber. . . . ¶Controversial renegotiation bill is bogged down. . . .

TIDELANDS—Oil industry alarmed at indications federal Government may not validate offshore leases if it gets full control of tidelands. . . . ¶Interim legislation appears stymied by intransigency of federal and state officials. . . . ¶California tidelands stipulation extended 1 year under terms purportedly giving federal Government more control.

TECHNOLOGY—Petroleum industry's use of radio growing tremendously. . . . Sets in use doubled in last year. . . . Spectrum getting crowded and industry committee asks for more wave lengths. . . . ¶Automotive engineers foresee use of gas turbines in ground vehicles. . . . Predict military will standardize on gasoline less wasteful of octanes. . . .

PRODUCTION—Texas sets September allowables at 2,823,000 bbl. daily. . . . Higher than August by 200,000 bbl., and may achieve all-time record. . . . ¶Osage area shows new life as lease bidding is brisk, prompted by water-flooding prospects and success with new techniques of formation parting. . . . ¶Alma area of southern Oklahoma is another very active spot. . . .

ACTIVITY—Crude-oil production averaged 6,620,525 bbl. daily for week ended August 19, up 24,975 bbl. daily from previous week. . . . ¶Well completions increased 26 wells for the week to 903 compared with 752 in same week last year. . . . Wildcat completions were up 40 wells to 190. . . . ¶Rotary rigs operating in United States on August 14 totaled 2,220 rigs compared with 2,185 a week earlier and 1,930 on same date last year. . . .

TRENDS—Refiners set two new records in week ended August 12. . . . Refinery runs averaged more than 6,000,000 bbl. daily for the first time and weekly gasoline production passed the 20,000,000-bbl. mark. . . . ¶Refinery runs for 4 weeks ended August 12 averaged 5,904,000 bbl. daily, almost 14 per cent greater than for same period last year. . . . ¶Additions to major-product storage were 60 per cent less than last year. . . .

INTERNATIONAL—World crude production in June topped 10,000,000 bbl. per day. . . . An increase of 15 per cent over last year. . . . Venezuela and Middle East at record levels. . . . ¶Tropical Oil Co. gets exploratory concession in northern Colombia. . . . Indicates it will remain active in the country. . . . ¶Rehabilitation of Gironde refinery gives Caltex a modern plant near Bordeaux. . . .

NATURAL GAS—FPC will expedite hearings on construction of gas-storage facilities to get New York natural gas needed for 1951-52 winter. . . . ¶FPC challenges rate increases of $3,200,000 requested by Northern Natural Gas Co. . . . ¶Oral arguments waived by FPC on pending applications by a number of companies planning to serve New England. . . . ¶Arkansas Louisiana Gas Co. awards contract for a compressor station at Blanchard, La., with a capacity of 65,400,000 cu. ft. daily. . . .

REFINING—Ethyl Corp. selects Houston as site for new plant to produce more than 100,000,000 lb. of chemicals annually. . . . ¶Lubrizol Corp. will manufacture petroleum additives in a new plant near Shell's Houston refinery. . . . ¶Shell has completed a specifically designed plant to produce solvents for odorless paint at Wood River refinery. . . .

PIPE LINES—Williams Brothers Corp. completing 32 miles of 16-in. crude-oil line from Redwater field to Edmonton, Canada. . . . ¶Lebanon-Syria-Jordan section of Trans-Arabian Pipe Line project is proceeding. . . . ¶Work is progressing on the Transcontinental Gas Pipe Line Co. project covering 85 miles of 30-in. southwest from the San Jacinto River, Texas. . . . ¶East Ohio Gas Co. will lay 24 miles of 20-in. from the Ohio-Pennsylvania boundary to the Austintown station. . . .

NEW RECORD.—This week United States refiners reported the highest activity in history. During the week ended August 12, crude runs to stills averaged 6,044,000 bbl. daily. Stimulated by unprecedented civilian demand and now the need to build stocks for a national emergency, runs have been climbing rapidly for many weeks (see our chart on page 220), but passing the 6-million mark is a milestone. This view shows the three catalytic crackers at the Lake Charles refinery of Cities Service Co.

War in Washington

Departments wrangling over administration of control bill while Congress still wrangles over what controls to vote

Bertram F. Linz

WASHINGTON. — Slowed down by Senate controversies over what should go into the measure, the Defense Production Act providing for priorities and allocations of vital materials is not now expected to be ready for President Truman's signature before next week.

In the meantime, however, the various departments which will share in the allocation responsibilities are perfecting their plans for the special agencies which will be set up for the job, after considerable in-fighting over who should control what, necessitating intervention by the President.

Reportedly, Interior Secretary Oscar L. Chapman made a bid for control of iron and steel because they are the product of minerals in which the department has an interest, while Agriculture Secretary Charles Brannon sought control of tin because of its wide use in food containers, and Commerce Secretary Charles Sawyer contended he should handle all materials that did not normally come under the jurisdiction of other agencies.

Administration.—The outcome is said to have been a decision by the President that the Commerce Department should handle all allocations of metals, while the Department of Agriculture could handle foods and the Interior Department fuels and other natural resources.

So far, Commerce had an edge on the other departments in planning for control administration, developing what will be known probably as the Defense Production Administration. However, Interior officials also were studying a mobilization set-up, reportedly along the same lines as the DPA and taking in the activities of the Oil and Gas Division and the related activities of other branches of the department. All this is to be under the supervision of C. Girard Davidson, assistant secretary for mineral resources, whom Chapman last month put in charge of the Oil and Gas Division, Bureau of Mines, and Geological Survey.

Foreign oil.—As plans for domestic mobilization moved slowly through the congressional machinery, steps were taken to prepare for international mobilization in the event of a greater emergency.

Six British officials, among them Keith Stock of the Ministry of Fuel and Power and Angus Beckett, new fuel and power adviser to the British Embassy, arrived in Washington last week for discussions of mutual availability and utilization of the oil resources of Britain and the United States in the event of an all-out war.

The conferences, closely guarded in secrecy, are expected later to include Canadian and Dutch officials and possibly representatives of other oil-producing countries which could be counted in the democratic line-up in any war with Russia.

Officials participating in the meetings are not discussing them, but it is considered possible that consideration is being given to development of an organized plant for the integration of military and civilian oil requirements of the United States and Britain should it be necessary.

Petrochemicals.—A special House interstate commerce subcommittee set up by Chairman Robert Crosser of Ohio to investigate the mobilization program will begin a study this week of the aviation-gasoline and synthetic-rubber supply.

The subcommittee will meet in executive session with officials of the Defense Department, and Interior and industry witnesses will be heard later in open sessions. The purpose of the investigation is to enable the committee to keep in constant close touch with developments in fields in its jurisdiction.

Tariff cuts.—Prospects for a wholesale cutting of tariff rates by the State Department at the conference on tariffs and trade scheduled to open September 28 at Torquay, England, have been dimmed by the Korean situation.

Because of the need of the Government for all the revenue it can develop to defray the cost of operations in Korea it is expected that plans to lower duties will be revised and such limited cuts as are made are now seen as likely to be confined to products whose free exchange will spur rearmament.

In announcing the Torquay conference earlier this year, the State Department listed several thousand items on which tariff reductions might be considered in negotiations with the 20 or more countries that are expected to participate. It is believed now that the items on which duties are cut actually will be relatively few.

Renegotiations.—Prospects for the enactment this year of new renegotiation legislation also have dwindled as a result of industry opposition to proposed provisions which would permit the renegotiation of prices paid for crude oil and natural gas by refiners and others having government contracts, and the difficulty of revamping the measure in time for action before Congress recesses.

The House ways and means committee, which heard representatives of the industry 2 weeks ago *(The Oil and Gas Journal, August 17, page 56)* is still working on the bill but currently is showing no inclination to rush it to the floor.

Tidelands Deadlock

Interim legislation appears blocked as federal, state, and operators' positions defy possibility of compromise

WASHINGTON.—Legislation for interim operation of the tidelands oil reserves appeared this week to have little chance of passage at this session of Congress because of the inability of federal and state officials and oil companies to get together on the terms of the measure.

A week of hearings by the Senate interior affairs committee developed the respective positions of the three interested groups:

1. Oil-company spokesmen expressed opposition to any legislation which did not validate leases granted by the states and insure their continuity so long as oil could be produced in paying quantities.

2. State officals demanded that administration be left in their hands, opposing the proposal to give the Interior Department authority to issue leases in the marginal sea and requiring that all revenues from operations be placed in federal funds for disposal when the basic issue of ownership of the tidelands is settled.

3. The Interior and Justice departments rejected the company proposals for amendments on the ground that validation of leases in what is designed to be temporary legislation would foreclose any action by Congress in a permanent measure to deal with them.

Departments balk. — In their reports on the resolution introduced by Sen.

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Joseph C. O'Mahoney of Wyoming, the two departments sought an amendment under which recognition would be given only to leases granted by the states up to June 23, 1947, (instead of the December 31, 1948, date proposed by O'Mahoney) on the ground that persons subsequently obtaining leases from Texas and Louisiana did so "with knowledge of the claims—and, indeed, of the rights—of the United States in such lands."

The departments also proposed an amendment limiting the area off of the Gulf states in which Interior could issue leases, explaining that because of the controversy respecting the location of the seaward boundaries of Texas and Louisiana it would be inadvisable to issue any leases adjacent to the coasts of those states. Under such an amendment, leases would be issued only on lands lying beyond the boundaries now claimed by the two states.

Both reports dealt in almost identical terms with the company proposals for validation of leases, Chapman explaining that they "would transform the interim authorization into a complete ratification of the state leases without anything being known by the Congress or by the executive branch of the Government respecting the terms and provisions contained in many of these leases. If permanent legislation on the subject of recognizing the equities of persons operating in the submerged lands of the Continental Shelf under state mineral leases is to be enacted, we believe that Congress should establish standards for such recognition."

Operators' position. — Another proposal that the companies should be protected against future claims by either federal or state authorities by being permitted to pay their rents and royalties to the state for transmission to the federal Treasury was rejected on the ground it would encourage the states to refuse to negotiate agreements with Interior under a section providing for the making of arrangements for operation in lands where a controversy exists over the question of status.

Oil-company witnesses appearing before the committee warned that unless some provision is made for assurance that leases will be continued, offshore development will be seriously slowed down. They told the committee that even now operations are lagging because of uncertainty over the future status of state leases. Rex G. Baker, chief counsel for Humble Oil & Refining Co., reported that as of June 1, last, only four geophysical crews were engaged in exploration of the Gulf Continental Shelf as compared with 40 in June 1948, and only 14 rigs were drilling as compared with as many as 23 at one time.

Baker estimated that the industry up to midyear had spent about $234,000,000 in exploration, drilling, and

WATCHING WASHINGTON

Bertram F. Linz

Tidelands Suspicions

Proposals to give the Interior Department interim management of the tidelands over which the Supreme Court, in three decisions, held the federal Government has paramount rights appear to have little chance of getting through Congress.

State officials and oil-industry representatives testifying before the Senate interior affairs committee intimated suspicions that the Government is seeking to get control of the submerged oil lands by back-door methods under legislation sponsored by Sen. Joseph C. O'Mahoney of Wyoming, committee chairman.

The states, bitterly contesting every step of the Government's effort to seize California, Texas, and Louisiana marginal belts, saw nothing in the legislation to support O'Mahoney's contention that it was designed to maintain the status quo until the basic issue of ownership has been settled and much to convince them that the Interior Department was seeking a new deal which would put it in the saddle.

Industry spokesmen, more concerned with the validity of offshore leases, saw omissions in the measure that in effect would give the department authority to terminate them before they had pulled out in oil the big investment necessary to develop them.

Back of the state officials are enough members of Congress supporting state ownership of the tidelands to defeat any effort to turn them over to Interior, and chances for enactment of the O'Mahoney resolution appear dim.

Korean Oil

American planes have been working over North Korea because more than 80 per cent of all Korean heavy industry, including refineries and synthetic-liquid-fuel plants, are located in that portion of the country which came under Russian control when Japan was defeated in 1945.

The five vital industrial centers in which the bulk of industry is concentrated were all badly crippled by Japanese sabotage before the surrender, but reports by the military indicate the North Koreans may have been more successful in rehabilitating their industry in recent years than many civilian experts believed possible.

In a recent review of Korea's industry, the National Geographic Society concluded on the basis of reports of bombings that large oil refineries had been in operation at Wonsan, one of three east-coast industrial centers.

During the period of Japanese control, at least two synthetic oil plants were constructed, one at Yongan with a reputed capacity of 50,000 tons, employing a new process for the liquefaction of anthracite coal, and a similar plant at Aoji, a little town on the 10-mile border between Korea and Russia and only 80 miles from the Soviet port of Vladivostok.

Civilian experts are generally agreed that the military capacity of North Korean industry was purposely restricted under Japanese rule, but observers believe that there may have been considerable expansion under Russian control.

In some respects, the National Geographic Society found, Korea has one of the largest industrial potentials in the Orient, with substantial deposits of coal, iron, and many other minerals. But most of these resources, together with 90 per cent of the electric power capacity, are north of the thirty-eighth parallel, the border of South Korea.

Rubber Outlook

Restrictions on the use of natural rubber may be announced by the Government within the next few weeks, part of the effort to build up a stockpile against a possible interruption of supplies from the Far East.

Facilities to give an additional 75,000 tons a year output of synthetic rubber are now being rehabilitated, and it is anticipated that a further increase in production of at least an equal amount may be ordered in the near future.

The stockpiling of rubber is being accomplished without cutting into production of rubber products by substituting synthetic for natural, and increased supplies can be made available for the stockpile by an increase in the proportion of synthetic required to be used in tires and other products.

In its most recent report to Congress of activities under the Stockpiling Act of 1946 the Munitions Board revealed that even before the Korean war it was considering elimination of the requirement for the use of natural rubber in heavy-duty truck tires, further reducing the country's strategic dependence on the Far East.

operating expenses against which it has secured revenues of only about $6,300,000. Such a disparity, he maintained, can be borne only if the companies have assurance they will be able to operate their leases so long as oil can be produced and thus secure a return of the investment.

States' contention. — Texas and Louisiana officials contended that administration of the tidelands should be left in the states until final settlement of ownership to prevent their being deprived of their rights and interests before Congress has enacted permanent legislation in which their equities will be considered. They also argued the states should retain the revenues from offshore operations.

While the question of interim legislation was being considered in Congress, state and federal officals gathered at the Department of Justice to discuss continuation of the stipulation under which the California tidelands have been operated since the Supreme Court decision. Department of Justice officials were reported opposed to continuation, apparently anxious to throw administration to the Interior Department, but state officals were hoping that an agreement could be reached although fearful that it might involve putting revenues in escrow in the Treasury.

Tidelands Funds

Stipulation change may increase federal power

WASHINGTON. — Royalties from the California tidelands hereafter will go into a special account in escrow in the federal Treasury under the terms of a 1-year extension of the stipulation between California and the federal Government following the Supreme Court decision 3 years ago.

Fred Howser, California attorney general, announced last Friday before the Senate interior committee that a renewal of the stipulation had been worked out between state and federal officials.

While revenues from here on will go into the U. S. Treasury, pending final settlement of this issue, those funds collected and impounded by the state since July 1947 will remain with the state.

The official announcement of the extension of the stipulation to October 1, 1951, stated: "The Secretary of the Interior is authorized to request the state to call for bids on new leases, and with the advance approval of the secretary, the state may enter into new leases where it is necessary to do so in order to prevent drainage of oil or gas from tide or submerged lands by wells drilled in other lands or otherwise to protect the interest of the parties involved.

"No change in the provisions of any lease subject to the stipulation, no extension of a lease, and no compromise or settlement of any controversy between the state and any leasee related to such lease shall be made unless the state gives the secretary at least 45 days' notice and the secretary shall have the power during this period to disprove such action. The secretary also has the right to examine and inspect the area, all operations within it, and all records pertaining to any lease under the stipulation."

Fuel Study Reconsidered

WASHINGTON.—An investigation of the supply situation in all fuels except atomic energy, to be conducted by the Senate interior affairs committee, was approved by the Senate last week, but a motion to reconsider by Sen. Elmer Thomas of Oklahoma left the probe hanging in midair.

INDUSTRY AFFAIRS

Oil's Radio

Use in petroleum operations doubles in past year, causing congestion of spectrum and demand for more frequencies

George Weber and Leigh S. McCaslin, Jr.

THE number of radio sets used by the United States oil industry to control its widespread operations more than doubled during the past year.

In June 1949 there were less than 5,000 units in use throughout the country. By June of this year the figure has risen to 10,450 sets being operated by 362 different concerns (see table). Source of these figures is the National Petroleum Radio Frequency Coordinating Association.

Forty-seven per cent of the petroleum radio stations are concentrated in Texas, Louisiana, Arkansas, and Mississippi. A belt approximately 75 miles deep along the Texas and Louisiana Gulf Coast contains the major portion of this concentration.

The association reports that the Scurry County boom has created a problem comparable to that existing in the Gulf Coast area. The large number of systems is making severe demands on the limited frequency spectrum allocated to the petroleum industry.

Eight categories.—A survey now in progress by the central committee on radio facilities of the American Petroleum Institute divides petroleum authorization into eight principal categories.

The greatest users of radio at present, and the fastest-growing group as well, includes oil, gas, and products pipe-line companies. A total of 75 pipe-line companies operate 312 fixed stations and 2,612 mobile stations, most of the latter being installed in passenger cars and trucks.

Oil producers rank second in their adoption of radio, with 46 producing companies employing 192 fixed and 1,232 mobile stations. Production, pipe line, drilling, and other uses are made of the 18 networks operated by integrated companies some of whose 279 fixed stations and 1,109 mobile stations are included in networks which blanket scores of states.

Generally smaller in areal extent, the 41 networks employed by drilling contractors comprise 192 fixed stations located in head offices, drilling rigs, and supply stores, and 448 mobile stations operated by owners, tool pushers, and drillers in company cars and trucks. Exploration crews, which were the first to adopt the rapid short-range advantage of radio in the field, now use 768 mobile stations. These portable stations generally comprise the total network, although of the 42 exploration firms using radio communication, two operate five fixed stations.

Refiners newcomers. — Among the newcomers in using radio are refiners. Five such companies use 16 fixed stations and 76 mobile stations

RADIO USERS AND UNITS IN THE UNITED STATES PETROLEUM INDUSTRY AS OF JUNE 1950

Region—	Users	Units
1. Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, West Virginia	20	886
2. Wisconsin, Illinois, Michigan, Indiana, Ohio, Kentucky	34	1,019
3. North Carolina, South Carolina, Tennessee, Alabama, Georgia, Florida	25	453
4. Texas, Louisiana, Arkansas, Mississippi	152	4,943
5. North Dakota, South Dakota, Minnesota, Nebraska, Iowa, Kansas, Missouri, Oklahoma	42	1,448
6. Montana, Wyoming, Utah, Colorado, New Mexico	61	1,319
7. Washington, Oregon, Idaho, Nevada, Arizona, California	28	382
Total	362	10,450

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in dispatching service vehicles and in some cases communicating with integrated producing and pipe-line facilities. Pipe-line contractors comprise another group which is adopting radio. Seven contractors now operate 6 fixed stations at home and field offices and 225 mobile units out on the spreads.

An eighth class which is designated under the petroleum category includes a number of companies which directly serve the petroleum industry in various ways. These include acidizing, aerial survey, salt-water disposal, barge operators, and shipping and communication companies. Fourteen such companies operate a total of 17 fixed stations and 182 mobile ones. Unclassified companies included in the petroleum category number seven which operate a total of 70 stations.

New application.—The growth of radio in the petroleum industry is well illustrated by the number of new applications which are submitted to the F.C.C. weekly. At the time that the survey was being compiled from F.C.C. files, 48 construction permits had been issued in expectation of eventual licensing of 148 fixed and 233 mobile stations. Fifteen applications were on file for an additional 38 fixed and 77 station licenses.

The use of radio predominates in the Southwest where leases are remote and drilling rigs may be separated from the nearest supply store by 100 miles or more. Pipe-line companies' major share in radio facilities also concentrate the networks in the principal producing areas of the Southwest. Extended systems paralleling pipe lines are a common case at the present time, and many such networks are reaching into the Northeast with the extended construction of long transmission lines to major marketing areas.

Saturation.—Adjacent-channel operation in many areas has helped solve the frequency problem. However, the coordinating association says, even with this measure the present rate of increase in usage demonstrates the serious inadequacy of available frequency space. The major portion of users in Texas and Louisiana are accommodated in the 48 and 50-megacycle band. Inspection of the concentration in this band reveals that saturation, from a user's standpoint, has already occurred.

At its recent annual meeting, the radio association decided that in the future it will be necessary to make "recommendations to the fullest in the less desirable 30 and 33-megacycle bands where sharing with other services and skip interference prevail." It was also decided that cochannel operation of stations in the same local area will be necessary in more and more instances.

It was predicted that an even more rapid expansion than has occurred during the past year will be experienced in the usage of microwave bands. This growth, it is believed, will necessitate early establishment of pertinent rules and regulations in order to insure orderly progress.

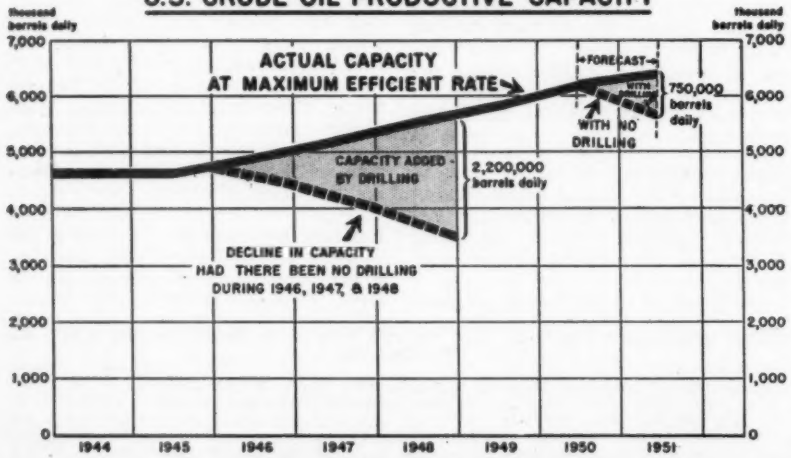
Organization.—H. A. Rhodes of Transcontinental Gas Pipe Line Corp., Houston, was elected chairman of the association at its Washington meeting. Other officers are: W. T. Bulla, Natural Gas Pipe Line Co. of America, Chicago, vice chairman; and E. H. Wilder, Sun Oil Co., Beaumont, secretary. Members of the national committee, in addition to the three officers, are: W. A. Shipman, United Fuel Gas Co., Charleston, W. Va.; J. D. McCullough, Buckeye Pipeline Co., Lima, Ohio.; L. C. Bomar, Southern Natural Gas Co., Birmingham, Ala.; G. F. McReynolds, Humble Oil & Refining Co., Houston; W. T. Born, Amerada Petroleum Corp., Tulsa; L. I. Duthie, El Paso Natural Gas Co., El Paso, Tex.; B. W. Sorge, United Geophysical Co., Pasadena, Calif.; R. S. Caplan, Gulf Oil Corp., Houston; and R. D. Wyckoff, Gulf Research & Development Corp., Pittsburgh.

The National Petroleum Radio Frequency Coordinating Association was organized a year ago to act as an advisory group to oil-industry concerns using radio in their work. The accelerated growth of this method of communication had created a problem of frequency coordination. Not only has the group made recommendations on all new installations, but it reviewed and adjusted most frequencies in use at the time of its organization. Although the group has no regulatory authority, its recommendations have been respected by the Federal Communications Commission.

The work pertaining to frequency coordination has been done by engineering personnel of many companies. These men are familiar with the field problems involved, the types of equipment used by the various companies, and the vagaries of propagation peculiar to the region. The frequency recommendations have been made on the basis of factual data.

EFFECT OF DRILLING ON

U.S. CRUDE OIL PRODUCTIVE CAPACITY



***PROP TO MER.**—The idea that the maximum efficient rate of crude-oil production is not a static figure but must be supported by constant drilling is well expressed in this chart, prepared by the Independent Petroleum Association of America for use by its committee studying the steel requirements of the industry. It shows how the nation's producing capacity would sag if the drilling props were removed.*

Big Inch Recapture

Texas Eastern's rights protected if U. S. moves

SHREVEPORT.—Texas Eastern Transmission Corp. considers its rights fully protected by provisions of the original contract in the event the Government decides to exercise its option to regain use of the former Big Inch and Little Big Inch systems.

Texas Eastern's purchase of the war-built pipe lines in 1947 was made subject to certain national-security provisions. These granted to the Government a "dormant estate" to be activated if the Secretary of the Army decided it was necessary to use the facilities for national-defense purposes.

R. H. Hargrove, president of the company, circulated a letter explaining these provisions, and accompanied by a copy of the pertinent clauses, among stockholders and brokers last week. Since the beginning of the war in Korea, he said, the company had had numerous inquiries regarding the provisions and the possibility of activation of the government's dormant estate.

"The company considers that the

rights of its stockholders are adequately protected by the provisions with respect to compensation for the use of its property in the event of the activation of the dormant estate, and accordingly, sees no logical reason for assuming any decline in current earnings in such eventuality," Hargrove said.

Requirements met. — "The company has complied with the requirements of the national-security provisions that it maintain the pipe-line facilities so that they may be made ready for use for the transportation of petroleum or petroleum products, as required therein, and the Office of the Quartermaster General of the Army has conducted periodic inspections to ascertain the company's compliance in this respect.

"In addition, the company is cooperating and will continue to cooperate with any agency or committee of the Government with respect to supplying information about the property or assisting the Secretary of the Army in forming an opinion. The company is confident that the Secretary of the Army will consider, in determining the necessity of national defense, the considerable contribution which the company's gas-transmission facilities will make toward a national war effort.

"It is by no means the intent of the company in furnishing this information to imply anything whatsoever with respect to any possible activation of the Government's dormant estate. Any statement on our part would at best be a mere speculation as to the opinion of the Secretary of the Army."

Hargrove drew particular attention to three paragraphs of the national-security provisions of the original contract. These provide that, if it becomes necessary to use the lines for national defense, the Government first will undertake to negotiate a contract with the company covering operation of the property. If the contract is not entered into, the Government can exercise its dormant estate but is required to pay the company reasonable costs and expenses and compensation for the use of the facilities at the "then prevailing normal rental."

The Big Inch and Little Big Inch systems were built to deliver crude and products to the East Coast from Texas. Construction came at a time when submarines were seriously interfering with tanker movements to the area. Texas Eastern converted the lines to gas after their purchase from the Government.

Kentucky Station

Texas Gas progressing with compressor work

THE Texas Gas Transmission Corp. is progressing steadily with its program of building compressor stations on its recently constructed 833-mile, 20 and 26-in. system extending from Carthage field, Texas, to Middletown, Ohio. These pictures show an over-all view of the station at Jeffersontown, Ky., and the fin-fan cooler there, one of the six new stations so far completed.

Four other stations on the system are scheduled to be finished by the middle of October. With the seven stations taken over from the old Kentucky Natural and Memphis Natural systems and since enlarged, Texas Gas Transmission will have a total of 17 stations. As a part of its continuing expansion, an eighteenth 4,500-hp. station in Kentucky is planned. This and other improvements will bring total capacity of the system to about 725,000,000 cu. ft. daily.

The 5,400-hp. Jeffersontown station is one of six built by Stone & Webster. Two others were constructed by Fluor Corp. and the remaining two of the 10 new stations by Texas Gas Transmission itself. Location and horsepower of the 10 new stations, besides Jeffersontown, are: Lake Cormorant, Miss., 7,600; Greenville, Miss., 8,400; Kenton, Tenn, 5,400; Sharon, La., 10,000; Slaughters, Ky., 4,800; Calvert City, Ky., 6,600; Bastrop, La., 8,800; Covington, Tenn., 7,500; and Clarksdale, Miss, 8,000. Included in the horsepower figures are some additions just authorized by the Federal Power Commission.

To Study Military Needs

WASHINGTON.—Military requirements for petroleum products on the West Coast will be studied by a special District 5 subcommittee appointed by Walter S. Hallanan, chairman of the National Petroleum Council. The group will function as a subcommittee of the council's general committee on military and government petroleum requirements.

The subcommittee has been asked to undertake its assignment immediately in order to be prepared to give prompt assistance on matters with respect to fulfilling the federal Government's military and other essential requirements for petroleum products.

The membership of District 5 group headed by R. G. Follis, chairman of the board, Standard Oil Co. of California, is: Gale L. Adams, General Petroleum Corp., Los Angeles; L. F. Bayer, Tide Water Associated Oil Co., San Francisco; Fred B. Behrens, Wilshire Oil Co., Los Angeles; G. A. Davidson, Standard Oil Co. of California, San Francisco; David E. Day, Richfield Oil Corp., Los Angeles; K. E. Kingman, Union Oil Co., Los Angeles; R. W. McOmie, Shell Oil Co., Wilmington; and B. O'Connor, The Texas Co., Los Angeles.

Above is a fin-fan cooler at the Jeffersontown station of Texas Gas Transmission Corp. Below is a general view of the same station, one of six recently completed.

XUM

Texas Allowable

September 22-day figure may give record output

AUSTIN.—Oil production in Texas will be greater in September than any other previous month.

The way was paved for the record level of production by Texas Railroad Commission at last week's September allowable hearing when it placed all fields except East Texas on a 22-day producing basis at the "most efficient rate." East Texas field production, also on the MER basis, was raised by the addition of two producing days over August figures, 21 days in September.

The 22-day producing period in 30-day September will result in an average calendar day allowable of 2,823,720 bbl., or 202,836 bbl. per day more than in August. Because actual production is always lower than allowable production, the commission estimated that the actual September oil production will be about 2,630,000 bbl. daily. This production would exceed the previous record set in December 1948 by about 100,000 bbl. per day.

Natural gasoline and distillate production for September was estimated at 305,644, bbl. per day, boosting allowable production figures for all petroleum liquids to 3,129,364 bbl. daily, or 150,000 bbl. more than at any previous time.

Boost Scurry.—Nearly half of the increase was accounted for in the Scurry County area, where production is from the new Canyon reef lime fields. These fields were left on the "yardstick" proration method for August while the remainder of Texas fields were returned to the MER proration method. The August restriction was necessary because available pipe-line capacity was too small.

Since the August hearing, however, Pan American Pipe Line Co. has completed a crude oil pipe line to the Scurry County region with a capacity of 37,000 bbl. per day. An additional outlet will be available later upon completion of an expansion of pipeline facilities by the Basin Pipe Line System which will amount to an additional 100,000 bbl. per day capacity. Some of this additional capacity will serve the reef fields. However, these additional gains in pipe-line facilities are believed by transportation officials to be insufficient to handle the additional volume of crude permitted under the new September allowable nearly 91,000 bbl. and anticipate that sizable quantities of oil may have to be run to field storage.

An accompanying table shows allowable crude oil production for the month of September by Railroad Commission districts. It will be noted that more than one-half of the total increase is represented by the East Texas field and District 8.

Raymond Myers, Dallas, representing Magnolia Petroleum Co., recommended placing of reef wells on a most efficient rate basis for 21 days, increasing them about 25 bbl. daily per well (35,000 bbl. total) over present allowables based on a difference formula. Myers said that pipe lines can handle this increase. However, he testified that a 22-day schedule would result in more oil than transportation facilities can handle.

Stocks deficient.—Ernest O. Thompson, commissioner, observed that it would be better to have too much oil aboveground at this time, than too little. He observed that U. S. stocks are 7,000,000 bbl. below the minimum safe working level of 245,000,000 bbl. recommended by most industry leaders. Moreover, Thompson said, both Shell Oil Co. and Phillips Petroleum Co. are importing more crude oil during August than usual, due to lack of sufficient domestic supplies.

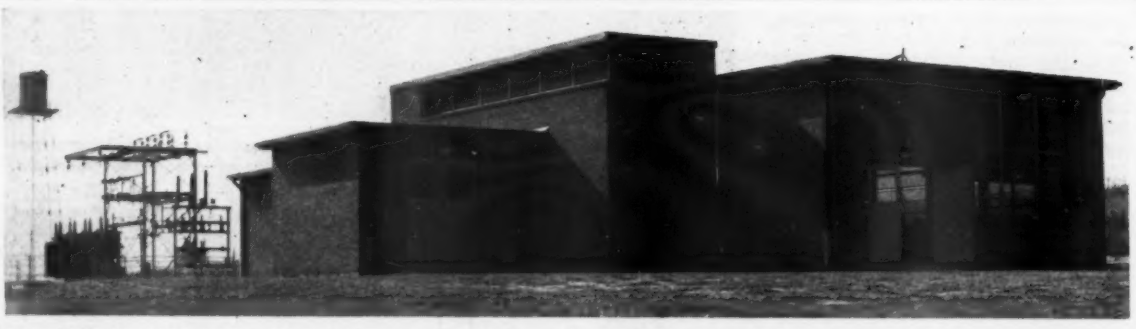
J. A. Neath, Houston, representing Humble Oil & Refining Co. recommended 21 or 22 days flow for Texas fields. He noted that despite a record refinery run of more than six million barrels last week, gasoline stocks dropped and some other products failed to show the usual summer gain. Humble needs at least 40,000 bbl. more daily during September over August requirements.

Etex pressures dropping.—Currently, the East Texas field produces 19 days a month and bottom-hole pressures have been dropping. Joe Zeppa, independent operator, insisted that the same number of producing days given to other fields should be assigned to East Texas, but H. P. Nichols, Tyler oil producer, recommended a 20-day limit.

The next proration hearing is scheduled for September 19. At this hearing the commission will hear testimony concerning the state's oil allowable and will consider a new rule which would apply to new fields and to fields where there are presently no field rules.. The new rule would base allowables 75 per cent on acreage and 25 per cent on wells. A proposed hearing on reduction of gas-oil ratio to 1,000 to 1 has again been postponed.

AVERAGE CALENDAR DAY ALLOWABLE FOR TEXAS FIELDS FOR SEPTEMBER 1, 1950, WITH NET INCREASE OVER ALLOWABLE FOR WEEK ENDED AUGUST 12, 1950

District—	Sept. 1 allowable	Net inc. over Aug. 12
1—Southwest	33,158	934
2—Southwest	159,984	11,132
3—Gulf Coast	484,092	25,157
4—Southwest	246,792	14,260
5—East Central	46,186	3,144
6—East Texas	308,793	36,771
6—Outside East Texas	110,264	6,677
7B—West Central	93,474	3,207
7C—West Central	67,819	3,395
8—West Texas	956,536	90,857
9—North Texas	202,439	6,285
10—Panhandle	114,183	17
Totals	2,823,720	202,826



BASIN EXPANDS.—Basin Pipe Line Co. is making engineering studies of the possibility of increasing the capacity of its line by 100,000 bbl. per day from Midland to Wichita Falls and 115,000 bbl. per day from Wichita Falls to Cushing. The crude line, running from Jal, N. M., to Cushing, Okla., now has a rated capacity of about 240,000 bbl. daily, which could be increased by adding pump stations. Above is a new station just completed by Basin at Lindsay, Okla. Similar stations are now under construction at Haskell and Odessa, Tex.

Osage Revival

Modern well-completion and water-flood techniques again make Osage Nation a happy hunting ground for oil men

Kenneth B. Barnes

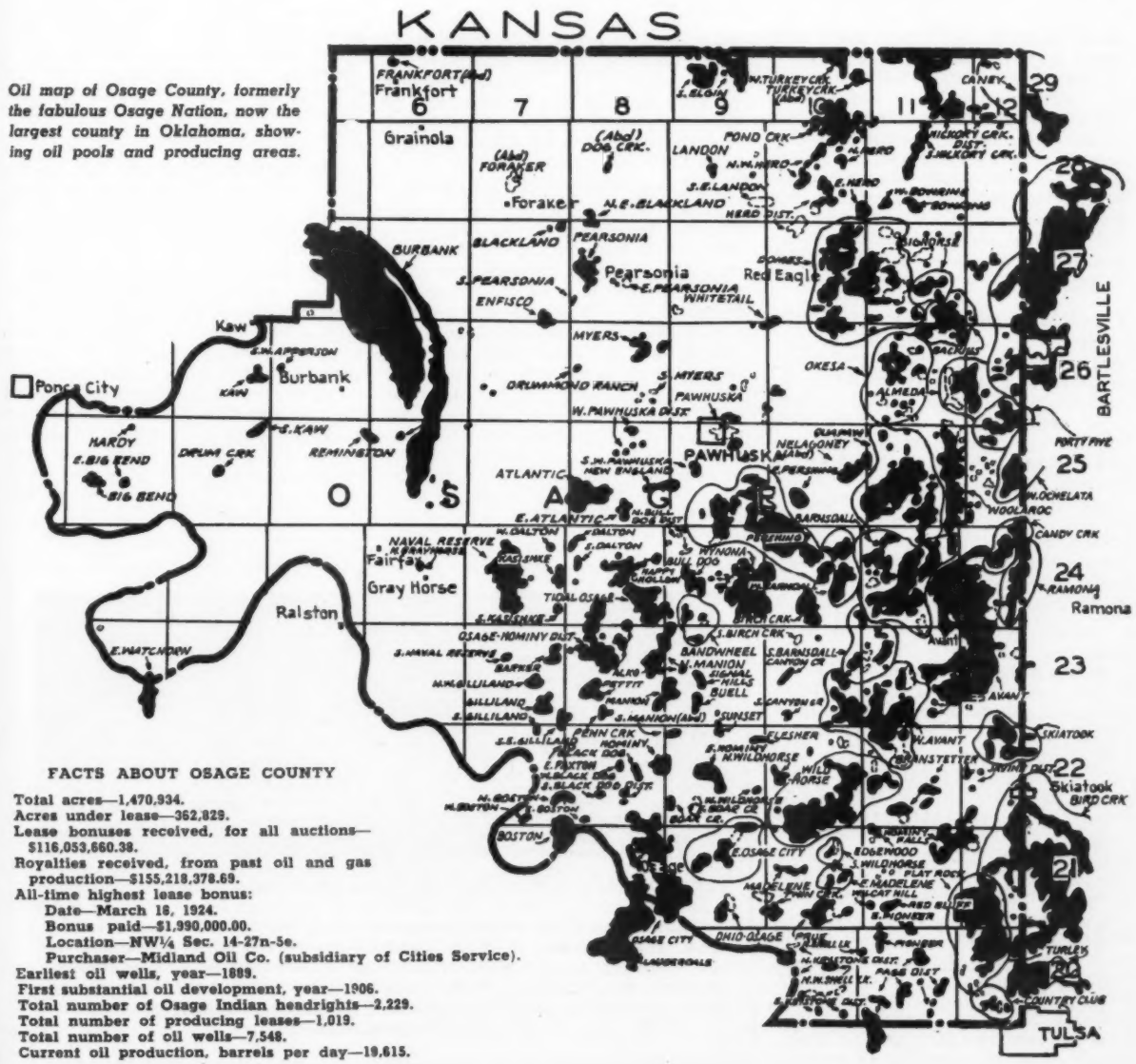
PAWHUSKA, Okla.—Modern operating techniques are bringing new life to the oil activities of the fabulous Osage, once the embodiment of the "get rich quick" oil rush of the 1920s.

Prompted by shallow drilling depths, large amount of proven oil-sand territory for water flooding, and bright prospects for application of new methds of well completion by formation parting, independent operators here last week bid spiritedly at open auction for oil leases at the Osage Indian Agency.

Leases totaling 52,536 acres were purchased. The bidders, chiefly from Oklahoma, Kansas, and Texas points, paid out a total of $194,800 at the open auction. This sale, while by no means approaching the fantastic auction prices that obtained in the heyday of the Osage, was significant because of a switch from the west to the east side of the county.

East-side play.—Drilling for oil and gas has been going on in Osage County for over four decades. The east side is shallower, mostly about 800 to 2,000 ft. Producing formations on the west side are somewhat deeper (up to about 3,000 ft.) and the territory has been less intensively prospected than the east. For a number of years, west-side leases have received higher prices at auctions due to the proximity of such good Pennsylvanian sand pools as Burbank, South Burbank, Naval Reserve, plus some Ordovician prospects, and with fewer dry holes in the territory.

This recent Pawhuska auction,



Oil map of Osage County, formerly the fabulous Osage Nation, now the largest county in Oklahoma, showing oil pools and producing areas.

FACTS ABOUT OSAGE COUNTY

Total acres—1,470,934.
Acres under lease—362,829.
Lease bonuses received, for all auctions—$116,053,660.38.
Royalties received, from past oil and gas production—$155,218,378.69.
All-time highest lease bonus:
Date—March 18, 1924.
Bonus paid—$1,990,000.00.
Location—NW¼ Sec. 14-27n-5e.
Purchaser—Midland Oil Co. (subsidiary of Cities Service).
Earliest oil wells, year—1889.
First substantial oil development, year—1906.
Total number of Osage Indian headrights—2,229.
Total number of producing leases—1,019.
Total number of oil wells—7,548.
Current oil production, barrels per day—19,615.

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therefore, is notable in that the bidders made a definite swing back to the east side, purchasing nearly 50 per cent more leases there in terms of acreage. Heaviest purchaser from acreage standpoint was Frank Buttram, Oklahoma City, who bought 4,960 acres, nearly all on the east side, for a total of $37,250. Buttram's purchases were motivated by the shallow depths, water-flooding possibilities, and prospects for good well completions by formation parting.

Presley Lomax, Bartlesville, purchased 960 acres for $5,150, reportedly for account of Cox & Hamon, Dallas, for possible water-flood development. Allen G. Oliphant, Tulsa, a longtime and successful Osage County operator, purchased 7,520 acres for $43,750. Oliphant primarily is a wildcatter and his purchases mostly were on the west side.

Shallow.—Depths of producing sands in Osage County vary from as little as a couple of hundred feet in a few freak pools to not much more than 3,000 ft. for some of those in the western and southwestern parts of the county. The Osage has a large amount of proven oil acreage. While it has been heavily prospected, discovery of new small pools and extensions is still fairly common. The county to date has produced 660 million barrels of oil and currently has 7,548 producing wells with an average production of 19,615 bbl. daily.

Formation cracking.—Well completions by the new technique of formation parting have been very popular in northern and eastern Oklahoma, including the Osage, since it was first commercially offered a few months ago. Formation parting, perhaps better known as the "Hydrafrac" process, was developed by the research laboratories of Stanolind Oil & Gas Co. *(see Journal articles, December 15, 1949, page 42; May 26, 1949, page 75; and October 14, 1948, page 76).* Field service is done by Halliburton Oil Well Cementing Co.

Osage Oil Inspector William Egan estimates that nearly 100 Hydrafrac treatments have been made in the Osage. Another formation-parting technique which is now available is "Strata-Lift," by Dowell Incorporated.

Pressure parting has been especially successful for oil sandstones of low permeability and tight texture, particularly the Red Fork and Prue in the Osage. The process also has been used on older wells which were not shot with nitroglycerin, or lightly so.

Secondary reserves.—Several Osage pools have been gas repressured for many years. As to water-flooding prospects, the Osage in the aggregate probably has more potential water-flood oil reserves than any of Oklahoma's other 76 counties. At present there are 10 water-flood pilot projects under way or nearly ready.

In water-flood-development programs, characteristics of the producing reservoir and its fluid contents, past production history, core analyses, and other factors are considered essential by all petroleum engineers. However, after these steps are taken, most engineers also are in agreement that the surest and over-all the most practical way of determining the susceptibility of oil fields to artificial water-drive operation, is through a pilot-plant project.

A pilot water-flood project is handled similarly to a pilot process carried on in laboratories or plant investigations. Usually one to a half dozen five spots are drilled and operated, with carefully detailed records maintained. In this way, cost and production information is accurately determined. If the pilot responds well, the water-drive development usually then is continuously expanded.

Pilot water floods.—The big Burbank pool in western Osage County (22,000 acres) will in the future constitute possibly one of the largest water-flood operations in the United States *(see Journal article December 1, 1949, page 37).*

Operators in Burbank late last year unitized all the producing leases. Phillips Petroleum Co. is the operator. At the present time in the south end of Burbank, a 160-acre pilot-type water flood is now in full operation. It has 16 oil wells and 9 water-injection wells which are taking an average of 600 bbl. per day each. The water injection has not yet been sufficient to achieve a "fillup," and consequently there has as yet been no increase in oil production.

Ohio Oil Co. has a pilot water flood in operation near 1 Walco, with water injection under way, and the firm also has a pilot flood 4 miles north of Barnsdall which is in active operation.

Cox & Hamon has a pilot flood ready for operation, located 4 miles south of Barnsdall. These operators also are now drilling a 500-ft. flood project on a pilot basis on leases 4 miles north of Hominy.

Sunray Oil Co. has a pilot-type water drive under way 4 miles northwest of Ochelata. In South Avant pool, Sinclair Prairie Oil Co., Sunray, McBride, and Shell Oil Co. have now completed preliminary engineering work for a water-flood development.

In the unitized South Burbank pool, where Phillips Petroleum also is the operator, an application is now in readiness for a water flood based on a pilot plan. In the producing area immediately north of the South Burbank unit, the principal operator, Kewanee Oil Co., is ready for a pilot-type water flood.

Naval Reserve pool, which lies southeast of North and South Burbank units, now is in process of organizing a unit operation, with The Texas Co. as operator. A pilot water drive operation is to be scheduled here.

Osage leasing.—This was the eighty-ninth oil lease sale held by the Osage Indian Agency, Pawhuska, for whom T. B. Hall is agency superintendent, and William Egan is oil inspector. Osage County lease auctions are a rather unusual event in the oil industry because the "headright" participants among the Osage Indians own the royalty for all of Osage County in toto, on an undivided basis. Any person legitimately interested and qualified who seeks to acquire unleased land in Osage may in advance notify the agency, who will consider, and usually place the acreage requested, on the docket for the next forthcoming auction.

***CONOCO LAB.**—Continental Oil Co. will start construction in September on this new laboratory building in Ponca City, scheduled for completion late in 1951. Its 40,000 sq. ft., nearly doubling Conoco's laboratory space, will house the central research work, including organic chemical, analytical, physics, and colloid laboratories, and also production research work. Much of the research will be on lubricating oils. More than 100 of Continental's 400 patents are in this field, and L. L. Davis, manager of the research department, is a pioneer in the development of synthetic additives and in lubrication research.*

Pipe Pool Sought

Kansas firm would beat controls by novel plan

WICHITA.—A plan for pooling tubular material for wildcat drilling in Kansas has been proposed as a national-emergency measure by Mountain Iron & Supply Co. of Wichita.

In a letter to all supply companies operating in Kansas, Mountain Iron said that the critical pipe shortage portends possible governmental intervention for allocating steel, but a voluntary system is more desirable than government control. The company said it would undertake to operate the pool if at least three other supply companies join in the plan.

A pipe pool, the letter said, would achieve two ends: It would increase the amount of wildcatting activity and therefore add to Kansas reserves for national defense; and it would help determine on an experimental scale whether the voluntary system is practical and whether it could be extended to the entire industry to prevent governmental intervention if an allocation program became necessary.

"In order to implement this 'Kansas plan,'" the letter said, "we suggest the establishment of an allocation committee of three persons to be selected, one from the supply industry, one from oil producers, and one from the Kansas State Corporation Commission. This committee would work out the various details of administration.

"Each participating supply company would furnish one string of casing and tubing to initiate the pool and additional casing and tubing as required. The pool, working with statewide wildcat statistics, could promote more wildcats than the present system, wherein each supply company must work on an individual customer basis. Pipe would be available to the operator only in the event it were necessary to run and after he had certified no other pipe was available. If the well was subsequently abandoned, pipe would be returned to the pool."

TECHNOLOGY

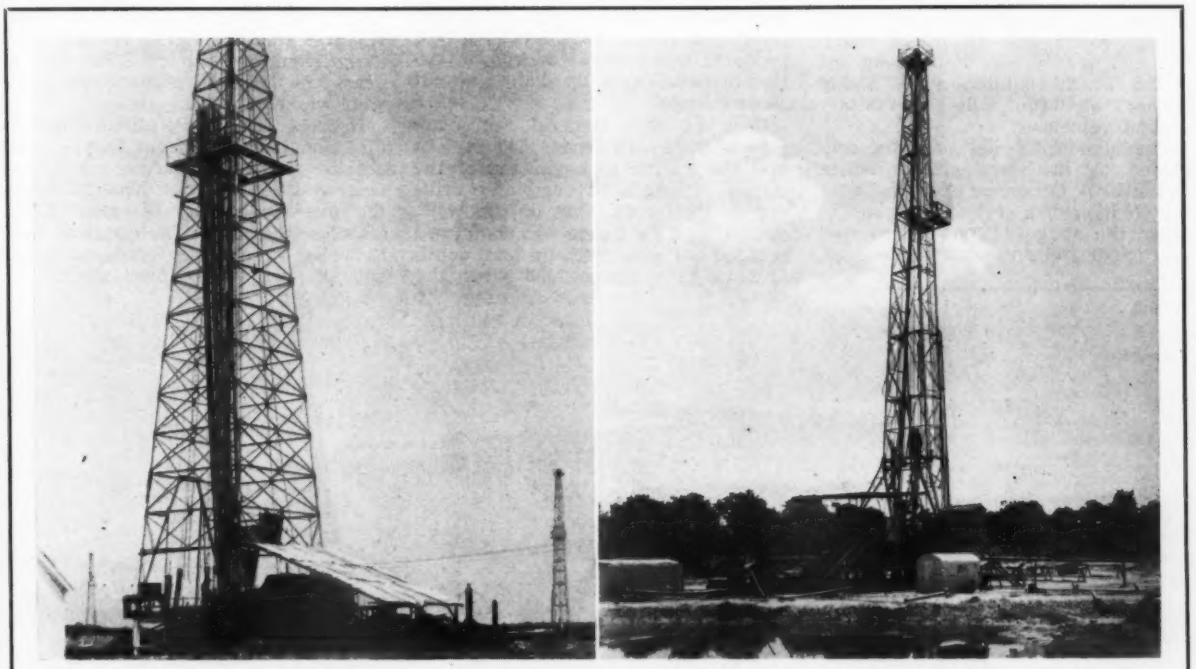
S.A.E. Looks Ahead

Sees a future for the gas turbine, standardization of military fuels, troubles with residue in lube oils

LOS ANGELES.—The shape of things to come in future petroleum fuels and lubricants was indicated in papers presented here last week at the West Coast meeting of the Society of Automotive Engineers.

A possibility for practical use of gas-turbine drives for ground vehicles was raised. An encouraging report on progress toward standardization of military engines for ground use promised greater utilization of the standard motor fuel which will power any future large-scale conflict. Pitfalls in the use of high-additive lubes were reviewed.

Gas turbines.—While the turbine engine is not yet proven, W. M. Brown of Kenworth Motor Truck Corp. concluded on the basis of preliminary tests with the new Boeing engine in a truck chassis that there is a place for the turbine engine in highway freight hauling operations subject to certain limitations. This qualified reversal of the past dim view which many S.A.E. spokesmen have taken



BUSY SPOT.—Drilling is active in the Alma area of southern Oklahoma where there is a good spread of proven and potential territory, a multiplicity of sands in the Pennsylvania section plus rich deeper horizons, and in some places a lenticularity of sands necessitating multiple drilling or completions. At left is a rig of Fain-Porter Drilling Co. drilling for Stanolind Oil & Gas Co. on the grounds of Alma Union Grade School. At right is Stanolind 1 Chickasaw Investment, SE SE SE 2-2s-4w, being drilled by Zephyr Drilling Co. in the Springer after proving a new pay extension in the Deese at 4,037-67 ft. This area poses nomenclature problems as Springer production is extended eastward from Velma toward Camp.

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of the gas turbine's ground application, again brings up the possibility that such a power unit might come into use.

In its present form the gas turbine uses more fuel than either the diesel or gasoline engine, but it shows less discrimination. Its adoption must await improvements in fuel economy, and the author stated his belief that it has not yet reached its maximum in performance and development. Against a higher fuel consumption in all ranges, the gas turbine offers adaptation to many low-grade, nonexplosive fuels whose octane or cetane numbers are immaterial.

Military fuels. — A look at military ground vehicles of the future shows promise of improvement from many standpoints, including that of the petroleum industry, according to Robert Insley, vice president of Continental Aviation & Engineering Corp. Before the last war was ended, he said, steps had already been taken to assure that the "succotash type" vehicle power-plant program of World War II should not be repeated.

Military success with the air-cooled tank engine has made air-cooling mandatory in future plans. Along with other specifications calling for maximum interchangeability of parts between models, operation on a standard 80-octane military general-purpose fuel indicates that planners intend to close the gap on octane requirements. This will go far in correcting the wasteful situation existing in World War II, where standard fuel quality was dictated by one model which required much higher octane than the bulk of military ground vehicles.

The standardization program conducted by the development section of the U. S. Ordnance Corps calls for the creation of a series of engines to cover the range of power required by current and projected military vehicles. Six basic engine models employing two cylinder sizes and ranging in power from 125 to 1,000 hp. were called for. All of these engines, designed and built by Continental Motors Corp., have successfully completed the Ordnance endurance tests, all have been service tested, and one model is now in production.

Heavy-duty oils. — A spokesman for the automotive industry, Hans M. Gadebusch of General Motors' Detriot Diesel Engine Division, expressed that industry's viewpoint on the need for reduced residue formation in high-additive lubricating oils. While improved lubricity, higher heat resistance, and lower sludging tendency has accompanied the trend toward higher additive content, he stated that the fourth property, residue-formation, falls short of requirements.

"While this shortcoming appears to be commercially tolerable with low-additive-content oils of the 'Heavy-duty' and 'Mil 2104' types," he stated, "it must be expected to establish a premature engine-life limitation for lubricants of the 'Super-Duty' type." Gadebusch conceded that further improvement of the relationship between engines, fuels, and lubricating oils should be attempted from the engine manufacturers' side by reducing the thermal load which the crankcase oil has to absorb.

In discussing the basic reasons for preponderance of gasoline-powered trucks, L. L. Bower of Waukesha Motor Co. cited the success in conversion or original design of the gasoline engine for use on L.P.G. fuels. He cited the horsepower gain, reduction of crankcase dilution, longer engine life, fuel economy, and cleaner operation of L.P.G. fueled trucks as advantages in that new development.

WEST COAST

Second-Hand Wells

G.P. reuses old holes in offshore drilling

D. H. Stormont

VENTURA, Calif.—"Hole economy" has been practiced to an unusual degree at a General Petroleum Corp. well in the offshore area of Rincon field near here. Last week a new producer was brought in from a portion of hole originally drilled almost 20 years ago.

Back in 1931, General Petroleum completed a pier some 650 ft. out into the Pacific to begin one of the earliest attempts at overwater drilling in California. One of the wells drilled, its 3 Ferguson, was completed as a 125-bbl. producer at a total depth of 2,610 ft. In March 1938, when the well was near exhaustion, the old hole was used in obtaining production from a deeper pay. By November of last year this second producer, and other wells, had virtually depleted the deeper pool.

Recently a third well was started through the original hole. In this case, however, a whipstock was set at 877 ft. and hole directionally drilled so that the third well was bottomed well away from the first two. Last week it was completed for 258 bbl. daily from a depth of 2,640 ft.—19 years and 1 month after the original well was completed.

In 1944 General Petroleum started directional drilling from the pier to obtain production farther offshore. One well reached out 1,800 ft. from the pier—to tap an oil sand 2,700 ft. below the ocean. The company has 22 wells, which have produced over 3,500,000 bbl. on the piers.

General Petroleum Corp. pier at Rincon from which oil production is obtained through 22 wells. Its 3 Ferguson is in the group of wells shown in the center.

World Production

Record crude output in June pushes global rate 15 per cent over last year to exceed 10,000,000 bbl. daily

Dahl M. Duff

RECORD increases in petroleum demand in recent months both in the United States and in foreign areas, have brought production from the world's oil fields to a new all-time high level.

Reports for June show total world output in that month at 10,438,000 bbl. daily. This represents a 6 per cent increase over the preceding month and a gain of nearly 15 per cent over June 1949.

It was the first time the world-production total has gone above the 10,000,000-bbl.-daily mark. Venezuela and the Middle East were at record levels in June, while output in the United States was moving back toward its previous high in late 1948.

The sharp and virtually unprecedentedly month-to-month gains in production have upset the estimates of some of the most optimistic of the industry's economists. This is particularly so in the case of production outside the United States.

One informed industry official said that of the several factors responsible, one of the most outstanding was a "galloping inflation." By this, he meant not necessarily a monetary inflation but a high level of industrial activity, shipping, transportation, and the like world wide.

In the view of this official, the greatly increased production is going into consumption and not storage. Reports indicate world storage generally is being drawn down except for the seasonal buildup of certain products in the United States. From a world standpoint, storage is not sufficient to account for the recent production increases.

There are several other reasons given for the recent gains. Opening of new facilities, new refineries, and notably the trans-Arabian pipe line, requiring heavy additional amounts of oil in working stocks. Removal of rationing controls and a better foreign exchange position in many countries are also contributing factors.

The 6 per cent increase in world production is artificial to some extent in that it was greatly affected by the early May strike in Venezuela. This pulled May production in that country down probably 200,000 bbl. daily below what it otherwise would have been.

However, Venezuela's output has continued at a greatly increased rate beyond the period which would seem to have been required to replenish what was lost during the strike. Venezuelan production in June was at a record 1,572,000 bbl. daily and preliminary July figures show about 1,535,000 bbl. daily.

June's record high world production was accomplished prior to the actual outbreak of the war in Korea late in the month. Whatever added military demand has resulted from

WORLD CRUDE-OIL PRODUCTION
(Thousands of barrels daily)

Country—	June 1950	Previous month	June 1949
Western Hemisphere:			
Argentina	66.0	65.7	62.4
Bolivia	1.5	1.6	1.8
Brazil	0.8	0.6	0.1
Canada	67.7	62.4	55.6
Chile	1.5	1.5	.....
Colombia	89.3	93.0	83.5
Cuba	0.3	0.3	0.2
Ecuador	7.0	7.0	7.1
Mexico	191.7	194.2	166.2
Peru	40.0	40.0	40.0
Trinidad	56.5	56.7	55.0
Venezuela	1,572.0	1,252.4	1,296.0
Total	2,094.3	1,775.4	1,767.9
Europe and Africa:			
France	2.5	2.0	1.1
French Morocco	0.7	0.7	0.4
Germany	21.5	21.5	16.5
Italy	0.2	0.2	0.2
Netherlands	14.3	14.4	11.8
Egypt	44.4	47.0	43.7
United Kingdom	0.9	1.2	1.0
Total	84.5	87.0	74.7
Middle East:			
Bahrein	30.8	29.3	29.9
Iran	687.0	670.2	549.3
Iraq	138.1	135.3	68.4
Kuwait	358.5	341.5	239.5
Turkey	0.8	0.8	0.3
Qatar	33.0	24.0	.....
Saudi Arabia	562.6	550.9	481.1
Total	1,810.8	1,752.0	1,368.5
Other Asia:			
British Borneo	82.0	82.0	68.5
Burma	1.5	0.5	0.5
China	1.3	1.3	1.5
India	5.2	5.2	5.3
Indonesia	130.0	130.0	125.0
Japan	5.6	5.4	3.8
New Guinea	5.0	4.8	5.9
Pakistan	3.8	3.8	1.4
Total	234.4	233.0	211.9
Total, foreign less Russia and E. Europe	4,224.0	3,847.4	3,423.0
Estimated Russia and Eastern Europe:			
Austria	22.0	22.0	18.0
Romania	80.0	80.0	92.0
Russia	730.0	730.0	635.0
Other E. Europe	23.6	23.6	19.0
Total	855.6	855.6	764.0
Total, foreign	5,079.6	4,703.0	4,187.0
United States	5,358.0	5,143.0	4,903.3
Total world	10,437.6	9,846.0	9,090.3

Figures are from reliable reports in the industry or official government sources. Data for Russia and Eastern Europe are based on competent estimates; no authentic information is available on production in these areas.

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this will not be reflected until subsequent months.

The June world total of 10,437,600 bbl. daily includes some 956,000 bbl. daily estimated production in Russia and its Eastern European satellites. No accurate month-to-month figures are obtainable on production in these areas.

Considering foreign production alone and excluding Russia and Eastern Europe, the June total was 4,224,000 bbl. daily. This was a gain of almost 10 per cent over May and about 23 per cent over June 1949. United States production at 5,358,000 bbl. daily in June was 4.2 per cent greater than May and 9.3 per cent above June 1949.

The marked increase in production in Venezuela from May to June represented a rise of more than 24 per cent, partially accounted for by the depressed level in May due to the strike. Slight declines were reported in June production in Mexico and in Colombia. However, both these countries expect a high level of production later this year; Mexico will probably go above 200,000 bbl. daily, and Colombia expects about 95,000 bbl. daily the second half.

Unofficial reports show some gain in output in Argentina in recent months. Brazil's small production is expected to rise considerably in September or October with the opening of the new 2,500-bbl.-daily Salvador refinery.

In Western Europe, German production at 91,200 metric tons in June was virtually the same as May—21,500 bbl. daily. Of the June total, 42,257 tons came from Emsland, 39,654 tons from Hannover, 8,797 tons from Schleswig-Holstein-Hamburg, and 492 tons from Baden. The figures show the increasing importance of the Dutch-Border Emsland area. Development of the new field, Lacq, in southwestern France, has increased output in that country. French production late in June was reported running at about 3,100 bbl. daily, including 1,900 bbl. daily from Lacq.

In the Middle East, two of the four major producing countries, Kuwait and Saudi Arabia, established new production records in June. The entire Persian Gulf area, as a result, rose to a new production high of 1,810,800 bbl. daily. This was a 3.4 per cent gain over May and a 32.3 per cent gain over June 1949.

Kuwait's June output was 358,500 bbl. daily, 5 per cent above May and 50 per cent over the 239,500 bbl. daily produced in June 1949. Saudi Arabia showed an increase of about 2 per cent, or about 12,000 bbl. daily, over May to reach 562,600 bbl. daily in June. Iran's output was up about 17,000 bbl. daily, but still below its record last March. Another small gain was reported in Iraq, but output in this country is limited by the pipe-line facilities and no major gains are expected until the completion of the new 30-in. to Tripoli, for which pipe has been ordered, or unless the long-closed Haifa branch is reopened.

Small increases in output were reported in Southwest Asia. A report from Burma said increased pacification in the country had allowed Burmah Oil to step up the rate at its field topping plant to about 1,500 bbl. daily. Pakistan's production is reported to have gained to about 3,800 bbl. daily, apparently as a result of further development in the Punjab region. Japanese producers are taking advantage of favorable summer weather to add to that country's output.

A lack of up-to-date reports continues to obscure the exact production rate in Indonesia. It appears that Indonesian output has been relatively stable the first half of this year at between 120,000 and 130,000 bbl. daily.

TREND OVER THE LAST YEAR

1949	W. Hemisphere less U. S.	Middle East	Total foreign less Russia and Eastern Europe
July	1,800.2	1,338.7	3,428.1
August	1,859.9	1,323.9	3,473.1
September	1,931.8	1,351.5	3,574.9
October	1,921.6	1,428.6	3,645.0
November	1,925.9	1,472.7	3,683.0
December	1,929.3	1,489.6	3,711.0
1950			
January	1,946.5	1,491.4	3,733.4
February	1,820.6	1,566.6	3,689.4
March	1,900.4	1,607.4	3,812.9
April	1,968.2	1,639.5	3,918.2
May	1,775.4	1,752.0	3,847.4
June	2,094.3	1,810.8	4,224.0

LATIN AMERICA

El Roble Plants Proposed

Construction of crude-stabilization and gas-processing facilities to serve El Roble field in Eastern Venezuela has been proposed to two oil companies by Edwin W. Pauley, California operator.

Pauley's proposal contemplates building facilities costing about $4,000,000. Hydrocarbon liquids extracted would be placed in the crude stream and Pauley would receive a percentage of the value added to the crude through the operation.

The oil companies involved are Pantepec Oil Co., S.A., holding 50 per cent interest, and Creole Petroleum Corp., which operates its quarter interest as well as the remaining quarter interest held by Mene Grande Oil Co. Pantepec has accepted Pauley's proposal; Creole has referred the matter to its Caracas management for study.

Capacity of the facilities planned by Pauley is reported to be 10,000 bbl. daily of crude and about 75,000,000 cu. ft. daily of gas. Roble field now produces about 4,500 bbl. daily with a gas-oil ratio of about 8,000. The plant would use its additional capacity for production from San Joaquin and other nearby fields. It is understood Creole, Socony-Vacuum, and Mene Grande have been studying facilities of this type for the area for some time before the Pauley proposal.

Concession Victory

Tropical wins long fight for north Colombian test

TROPICAL OIL CO. has been granted an exploratory concession in northern Colombia covering about 120,000 acres in the Magdalena Department, about 50 miles south of Barranquilla.

For Tropical, the concession represents a continuation of exploratory work which the company has carried out in various parts of Colombia over the last 14 years. This wildcatting is in addition to the Tropical refining and production operations in De Mares concession, and its products marketing throughout Colombia.

The Balsamo block comprising the new Tropical concession has been under application for a number of years. Private-property claims held by a local Colombian company have heretofore prevented a firm grant of the concession, but Colombia's recent amendment of its oil laws allows award of the concession with final settlement of the claims later.

Nine dry concessions.—The Tropical organization is expected to drill on the block probably in the first half of next year. Aside from De Mares, which is Colombia's major source of production, Tropical has drilled in nine government concessions and two private properties since 1936 without success.

In Bogota, Colombian Government officials termed the new concession "very important" and said that the contract showed Tropical will not withdraw from Colombia next year. The company's future has been a subject of speculation. The De Mares concession reverts to government ownership in August 1951, and Tropical recently transferred its marketing properties to a new company, Esso Colombiana, S.A.

The concession indicates that Tropical will continue active at least in the exploration field. Some time ago it turned down an offer to participate as a minority partner with the government in De Mares after reversion, although some still feel that a management contract to operate the concession remains a possibility.

There has been considerable speculation in Colombia that Tropical might withdraw from operations in the country after the De Mares concession reverts to the government, particularly after formation of the new marketing company, as legal and title problems made it difficult to obtain additional concessions to continue exploration and development work.

Main gate of the newly reconstructed refinery of the Caltex group at Bec d'Ambes, southwest France.

EUROPE

Gironde Refinery

French reconstruction of major war-damaged refinery gives Caltex group virtually a new plant in Bordeaux area

A TWO-YEAR reconstruction program costing more than $8,000,000 has been completed by the California Texas Oil Co. organization to provide a virtually new modern refinery in Southwest France.

The refinery is located on a 16-acre site on a finger of land near Bec d'Ambes at the junction where the Garonne and Dordogne rivers flow into the Gironde 15 miles north of Bordeaux. Operating company is Raffineries de Petrole de la Gironde.

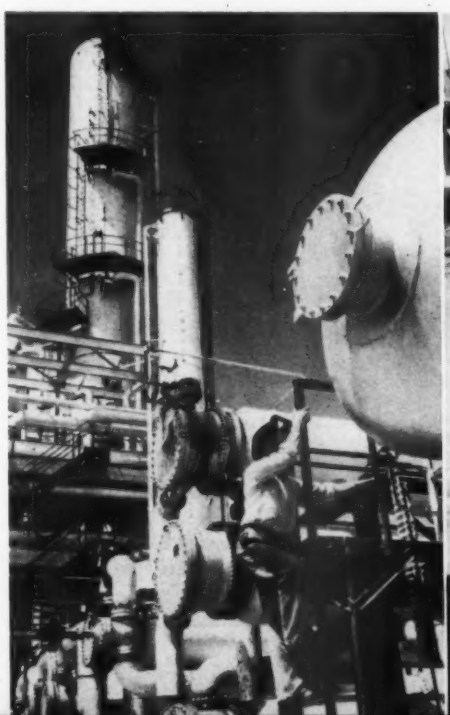
W. H. Pinckard, Caltex chairman, announced this week that the refinery has now reached capacity operation processing 14,000 bbl. daily of Arabian crude into gasoline, kerosine, diesel, gas oil, as well as light and heavy residual oils for fuels.

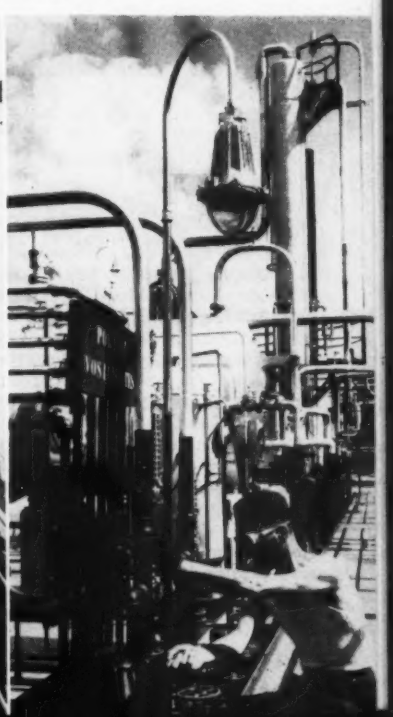
The plant was virtually destroyed during the war, but as a result of its reconstruction, production is planned at a yearly rate of about 600,000 tons, more than double its prewar output. Tankage consists of 960,000 bbl. new capacity and 410,000 bbl. rehabilitated.

Design.—The crude-distillation unit is designed for a throughput of 14,000 bbl. per stream day, which allows charging 12,400 bbl. on a calendar-day basis. The atmospheric column separates crude into one whole gasoline cut, one kerosine-distillate cut, two gas-oil cuts, and residuum. Minimum residuum yield is 35 per cent of crude.

The crude-distillation unit has

View at left, below, shows heat exchangers of the topping unit at the refinery; center photo is a view of a loading operation at the barge dock on the Dordogne River; picture at right shows the drawing of a sample at the treating unit.





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naphtha cut for sweetening and blending into finished gasoline. Naphtha bottoms are charged to the naphtha reformer unit. A stabilizer debutanizes (or depropanizes, depending on finished gasoline vapor demands) light straightrun naphtha.

The thermal reformer with a U.O.P. process can charge 3,200 bbl. per stream day of heavy naphtha and has towers for vapor-phase clay treatment of reformed naphtha. A reconditioned stabilizer controls vapor pressure of the naphtha reformate. The unit's design permits flexibility in reforming severity to permit variation of the product octane number for a reasonably wide range. Gas produced by the unit goes into the refinery fuel system.

A 3,650-bbl. lead-sulfide gasoline-treating plant sweetens light naphtha from crude running and gasoline reformate, and there are facilities for inhibiting and ethylizing sweetened gasoline. A 380-bbl.-capacity batch-treating plant sweetens kerosine. Chemical storage facilities prepare and store reagents required for these treating plants.

Heavily bombed.—In the reconstruction of the refinery it became apparent that pile supports would be needed for the heavy equipment. The ground site had originally been built from alluvial fill, while 40,000 tons of sand were needed to level off the ground. Of all the remains after the bombing, the power plant alone emerged relatively undamaged. It was reconditioned to provide steam-generating capacity of 115,000 lb. per hour. Electric generators with a 1,300-kw. capacity service the unit, while an 11,000 g.p.m. pumphouse supplies cooling water from the Dordogne River.

Pier facilities have been expanded. Tankers can move upriver from the sea about 50 miles away and tie up at the plant site to discharge crude. Tankers of 15,000 tons capacity moor at one pier, while coastal vessels and inland barges are tied up nearby loading finished products. Overland freight movement by rail and truck originates virtually at the tank side. Loading ramps can accommodate 50 tank cars and 40 trucks.

Pinckard pointed out the Gironde refinery was rebuilt as a part of France's so-called Monnet plan. This plan called for country-wide industrial rehabilitation and provided for restoration of four large-capacity refineries at strategic points throughout France. The Ambes plant is in the center of the Southwest industrial area and is expected to supply fuel to stimulate manufacturing expansion in the region.

Rebuilding program.—The refinery was originally built in 1932 with an 8,000-bbl. daily capacity. It was first bombed in 1940. Allied strategic bombing in 1944 wreaked such havoc that "100,000-bbl. storage tanks were turned upside-down like teacups." Because refineries that suffered partial rather than complete damage were permitted to rebuild first, authorization for the Gironde plant did not come through until 1947. Reconstruction work was started in 1948.

Contracts were let with coordination from the Caltex New York office. Arthur G. McKee Co. was charged with designing the process installations, while local engineering groups worked on rehabilitating existing installations besides tankage, utilities, sewage, fire-fighting, and dock facilities.

Pinckard pointed out that the reconstruction of the refinery was unusual in that it was accomplished without use of funds from the European Recovery Program. About 60 per cent of the materials was obtained in France itself, and at the peak of construction some 1,200 men were employed. Operation of the refinery will require 340 local and 4 American employes.

At the inauguration ceremonies for the refinery, French officials suggested the need for still more refinery capacity in Southwest France, possibly a total of 2,000,000 tons of annual production. "We must create sources of power and petroleum is one of the principal sources," M. Taix, technical counselor for the Ministry of Commerce and Industry, told the group at the inauguration. "The starting up of the refinery has brought new elements for the development of this region."

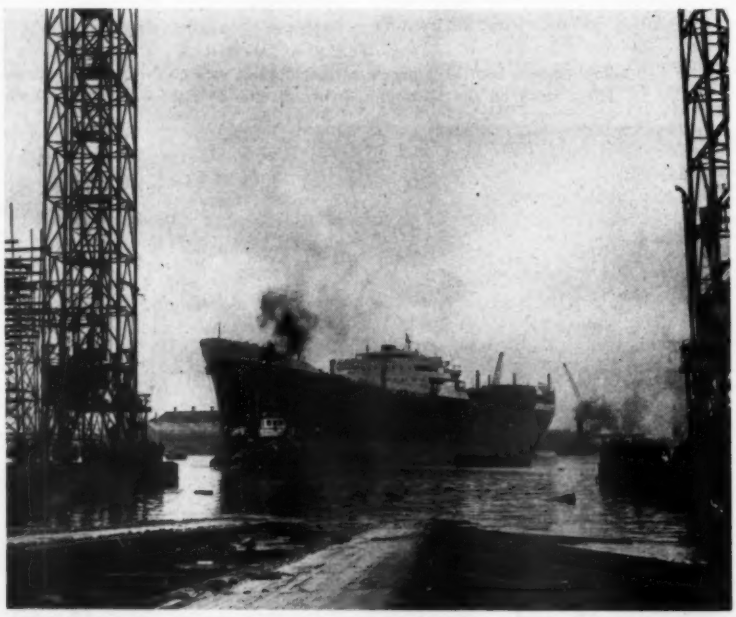
The Gironde refinery is the second of the Caltex group to go into post-war operation in Europe. Earlier this year a new Caltex refinery was completed at Rotterdam at a cost close to $24,000,000 and with a 20,000-bbl. daily capacity. This refinery will serve Holland, Belgium, Luxembourg, and Switzerland.

Spain Reserves Oil Area

Productive wells across the French border have encouraged the Spanish Government to reserve a large area near the central Pyrenees for oil exploration. The Spanish National Institute, a state-owned organization, has taken the formal steps towards testing the south side of the mountain range. The prospective development stretches from the Pass of Roncesvalles to Canfranc.

North of the range, the Lacq area in southwestern France has made three completions producing about 1,900 bbl. daily. The production came from Upper Cretaceous limestone at near 2,000 ft. Seismic work has indicated similar structure to the south and east.

These findings have raised Spanish hopes that the structures continue along the south slope of the Pyrenees. On the French side, the structure is a dome which was outlined by reflection seismograph. Preliminary surveys indicate a similar formation may extend into the Spanish Pyrenees.



SHELL TANKER.—Above is the Verena, second of four new 28,000-ton tankers for the Shell fleet, which was launched from Harlan & Wolff's Belfast Yard on June 29. The ship will carry crude from the Middle East to Shell's new United Kingdom refineries. (Shell photo.)

Outbluffing the Russians

Van Sickle refuses to let Soviets swallow up oil properties his firm developed in Lower Austria

ONE of the few citizens of the Western Powers who has had any success in dealing with the Russians on their own ground is a 50-year-old Canadian oil operator, Richard K. Van Sickle.

Van Sickle has refused to allow the Russians to swallow up the substantial producing properties which he developed prewar in Lower Austria and now located in the Russian Zone of Occupation. By plain talking and standing on his rights, he has not only obtained payment for oil taken by the Soviets but also has regained management.

Van Sickle and his company continue to maintain headquarters in Vienna. The production amounts to about 1,100 bbl. daily from some 80 wells in the Vienna Basin. The oil taken by the Russians is paid for, although at a price around 40 per cent of the world market level.

Van Sickle represents the third generation of a Canadian oil family. His grandfather explored in the Petrolia, Ont., region shortly after the Drake discovery. Van Sickle himself was born in Romania and moved with his family to Canada in 1910 after his father sold the Romanian oil interests he had developed in the Ploesti region.

After receiving his education in England, including a master of science degree at Cambridge, Van Sickle went to Romania as a driller and tool pusher. He entered the contracting business in Romania and in the early 30's turned to drilling on his own account in Lower Austria.

Here he had marked success, with his first well a producer. By the outset of the war in 1939 when he was forced to leave the country, he had built up an important producing operation. All this Austrian property was taken over by the Nazi Enemy Property Office and administered for their own benefit.

During the war, he entered the British Army, drilled for water in the North African desert, and later served as oil attache at Baghdad and Teheran. When he returned to Austria in December 1945, he found the Russians in charge of his properties.

Van Sickle has refused to be muscled out of Austria. He demanded and obtained payment for his oil, thereby establishing private rights to properties which the Russians assumed were theirs under the Potsdam Agreement since they had been held by the Nazis during the war.

George L. Ellis has been named division geophysical coordinator for the North Texas-New Mexico division of Stanolind Oil & Gas Co. A senior geologist at Fort Worth since December 1948, Ellis joined Stanolind in July 1945. He received his bachelor's degree in petroleum and mining geology from Pennsylvania State College in 1917.

James R. January, Magnolia Petroleum Co., has been placed in charge of joint-ownership plants and other joint-ownership gas interests of the company. The additional duties creates a new departmental assignment within the natural-gas department.

Jean M. Barrett, production engineer for Pure Oil Co.'s Dollarhide, Tex., operations, has been moved to the Fort Worth office, replacing **Stanley G. Britton,** who has been transferred to Dollarhide. **Leroy Conn,** geologist at Abilene, Tex., and **James H. Parrish,** Midland, Tex., geologist, have been transferred to Fort Worth.

F. O. Mortlock and **C. C. Stevens** have been named division geophysical supervisor and division disburser, respectively, of the Fort Worth division of Gulf Oil Corp.

Wilson Selner and **Frank C. Colegrove** have been appointed vice presidents of Allied Oil Co., and **K. D. Baskett, Jr.,** has been named assistant to the president of both Allied Oil and Frontier Oil Co. Selner formerly was marketing manager and Colegrove was assistant to the president of Allied Oil.

Dr. Gustav Egloff, director of research for Universal Oil Products Co., Chicago, has been elected a Fellow of the Royal Society of Arts of Great Britain.

Malvin G. Hoffman, a specialist in international petroleum affairs in the Department of State at Washington since 1946, has resigned and will make his home in Ardmore, Okla. During World War II, he was chief of the petroleum reserves section of the Petroleum Administration for War.

E. W. Adams and **E. W. Thiele,** both assistant directors of research for Standard Oil Co. (Ind.), have been named associate directors of research, the title of assistant director being abolished. Other appointments and their assignments within the department include: **A. L. Conn,** pilot plants; **J. B. Duckworth,** automotive research; **Nathan Fragen,** all research activities in the field of chemical products; **C. M. Loane,** research on lubricants; **J. E. Seebold,** process design and economics; **B. H. Shoemaker,** exploratory studies in connection with the firm's major products; **E. B. Tucker,** analytical research; and **P. C. White,** research on fuels and special products. The company announced that **R. C. Mallatt** has been named chief chemist of the Whiting refinery, and that the following section leaders have been appointed: **H. R. Taliaferro, L. W. Mixon,** and **W. R. Hertwig. R. W. Watson, C. W. Brackin,** and **R. L. Yahnke** are new group leaders. Dr. Adams, a

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PERSONALS

E. W. ADAMS

E. W. THIELE

graduate of the University of Illinois and University of Wisconsin, joined Indiana Standard in 1925. He became assistant director of research in 1945. Dr. Thiele received his degree from Massachusetts Institute of Technology, and joined Standard's research staff in 1925. He was named assistant director of research in 1935.

Minor C. Sumners, assistant to the president of Arkansas Power & Light Co., has been named president of the newly organized MidSouth Gas Co., which is proposing to build a natural-gas pipe-line system in eastern Arkansas. Sumners, a native of Crossett, Ark., attended Arkansas Polytechnic College. He entered the utility business in 1928, when he joined Arkansas Power & Light Co. He interrupted service with that company in 1944 when he became chief accountant for Arkansas Department of Public Utilities, but returned to Arkansas Power & Light in 1948.

W. L. Horner, formerly chief production engineer for the former Barnsdall Oil Co., Tulsa, has been named chief petroleum engineer of Sunray Oil Corp.'s production department, and will be in charge of all engineering activity in the Mid-Continent division. Sunray's new production-engineering section combines the engineering personnel of both Barnsdall and Sunray. Other changes include: **J. D. Adkisson, Jr.,** named supervisor of the department, and engineer in charge of its water-flood section; **George P. Alden,** named water-flood engineer; and **Dr. Charles W. Ziemer,** named supervisor of reservoir engineering; **R. H. Parker** and **Walter Kellogg,** named engineers, reservoir - engineering department; **Don W. Roark,** appointed laboratory technician; **L. B. Jeffers,** named proration engineer, and **Burns H. Errebo,** named engineer in the reservoir-engineering department. Assigned to the production department are: **R. K. Waddell,** geological engineer; **V. M. Williams,** drilling-mud engineer; **W. L. Hagan,** mechanical engineer; and **W. P. Parker,** salt-water-disposal engineer. **Donald L. Moore** was named junior engineer.

W. L. HORNER

C. R. Middleton has been appointed manager of the Stanlow refinery of Shell Refining & Marketing Co., Ltd., at Ellsmere Port in Cheshire, England. He succeeds **F. Mackley,** who has been transferred to the company's main office in London. Middleton joined Shell during 1924 and has served in nearly all of the refinery operating areas of the Shell Group throughout the world.

Preston J. Schowalter has been elected secretary of Pan-Am Southern Corp., New Orleans, replacing **Thomas E. Beaird,** who will move to the firm's Shreveport office and continue in service in an advisory capacity and as secretary of one of the subsidiary companies. **George Thornbury,** budget analyst, will replace Schowalter as assistant secretary.

R. M. Hess, Shell Oil Co., Houston, has been promoted to the newly created position of division production superintendent. **E. G. Christianson,** division exploitation engineer, Franklin, La., has been transferred to Houston to replace Hess. Other changes include: **J. L. McCray,** exploitation engineer, East Texas division, to division reservoir engineer; **I. L. Black,** chemist, Houston, to Lake Charles, La., in the same capacity.

J. F. Jeansonne, district petroleum engineer, Humble Oil & Refining Co., Mallalieu district, Louisiana division, has been transferred to the Odessa district, West Texas division in the same capacity. Other changes include: **E. T. Mace,** tool pusher, Wasson district to Mallalieu district; **Fred B. Van Shoubrouek,** tool pusher, Louisiana division, to the McCamey district; and **W. W. Holland,** tool pusher, Eucutta, La., district to the Winters district, North Texas division.

O. O. Floyd, Oklahoma City, British American Oil Producing Co., has been transferred to Houston as chief clerk. **R. N. Fogelson,** Tulsa, production clerk, has been transferred to Houston in the same capacity.

David English, Sun Oil Co., junior petroleum engineer trainee at Garcia, Tex., has been promoted to junior petroleum engineer and transferred to Robert Lee, Tex.

Doyle E. Stegall has joined Sun Oil Co. as junior petroleum engineer at Sun field, Texas.

Frank A. Lawrence, junior petroleum engineer, Sun Oil Co., has been made field engineer and transferred from Delhi, La., to Sun field, Texas.

Charles E. Rogers, junior petroleum

VENEZUELAN DELEGATES.—Above are Venezuelan delegates to the International Trade Fair held recently in Chicago, with Mayor Martin Kennelly. Left to right: Rafael Omaña, representing the Caracas Chamber of Industrialists; Celestino Diaz, representing Caracas Wholesalers Association; Dr. Eduardo A. Acosta, petroleum expert; Ruben Nevado, head of the mission representing Dr. Manuel Egaña, minister of development; Mayor Kennelly; Gustavo Zingg, Jr., Caracas Chamber of Commerce; and John P. Lee, selected by the Venezuelan Government to represent Standard Oil, Shell, Gulf, and other companies operating in that country.

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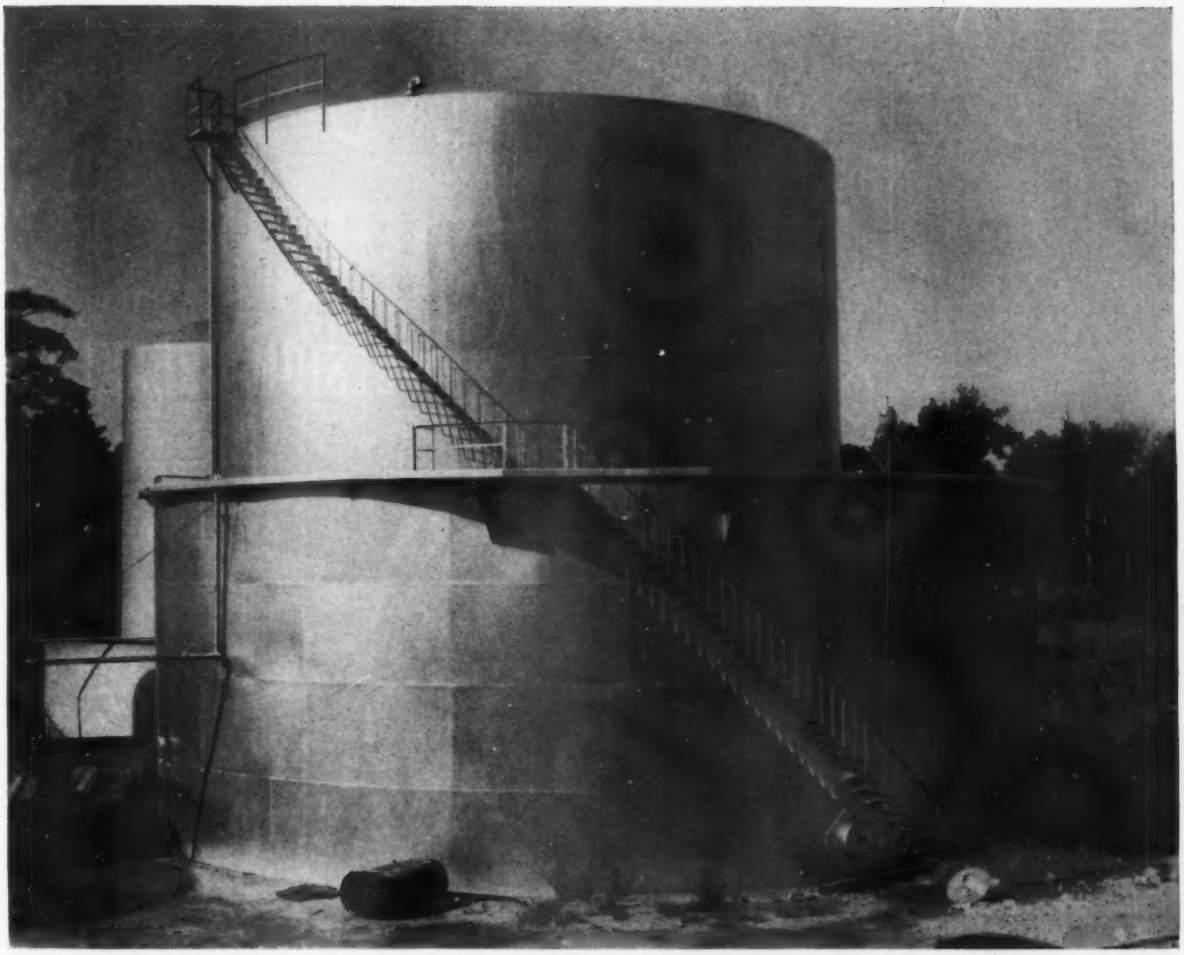

EIGHTH Horton* tank for Stamford bulk plant

The 15,000-bbl. cone roof tank shown in the above view is the eighth welded steel oil storage tank that we have supplied for the Stamford, Connecticut, bulk plant of the Independent Oil Company of Connecticut.

Repeat installations like this are an indication of customer confidence in our products. We believe our continuous selection as the supplier of these tanks is based on two factors—(1) the numerous advantages of welded steel tanks and (2) our ability to fabricate and erect at reasonable cost a tank that gives good service.

You can place your trust in welded construction because it offers . . . dependable oil-tightness, the joints are built tight and *stay* tight; economical maintenance, regular painting keeps the tank in good condition for years; and long service life—there are no sharp corners to collect dirt and invite corrosion.

You can depend on our ability because we have adequate shop fabrication facilities and the experienced erection crews to furnish tanks and other steel plate structures at an economical cost.

Horton flat-bottom storage tanks are built in standard capacities up to 268,000 bbls. or in special sizes to meet your particular needs. Write our nearest office for information and quotations.

• • • •

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Cleveland, 15.....2204 Guildhall Bldg.
Detroit, 26.....1514 Lafayette Bldg.
Havana.....402 Abreu Bldg.
Houston, 2.....2119 National Standard Bldg.
Los Angeles, 17.....1523 General Petroleum Bldg.
New York, 6.....3347—165 Broadway Bldg.
Philadelphia, 3.....1615-1700 Walnut Street Bldg.
Salt Lake City, 4.....525 West 17th South St.
San Francisco, 4.....1554—200 Bush St.
Seattle, 1.....1325 Henry Bldg.
Tulsa, 3.....1606 Hunt Bldg.

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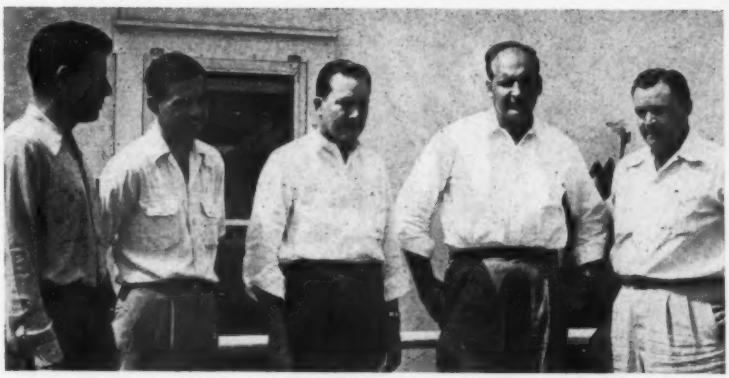
engineer, Sun Oil Co., Dallas, has been transferred to Colorado City in the same capacity.

J. H. Russell, vice president and veteran executive of Gulf Oil Corp., will head the crude-oil purchasing and pipe-line transportation activities which will be established as separate and primary departments of the company effective September 15, 1950. **Ben C. Belt** will become vice president in charge of the crude-oil production functions formerly directed by Russell in the Houston division. Russell, with nearly 30 years of experience in the oil industry, joined the Gulf at Houston in 1921 and by successive stages rose to executive ranks, becoming vice president in charge of the production division at Houston in 1944. Belt, who has been with Gulf for 26 years, joined the company as a geologist in 1916. He has been closely connected with exploratory and developmental operations in Mexico, Mississippi, Texas, Louisiana, and Arkansas. Prior to his election as a corporate vice president last May he was in charge of exploratory activities in the Houston production division.

Robert S. Hotz has been appointed by Woods Drilling Co., New Orleans, to take charge of its New York office. He will serve the company principally in financial matters, having formerly been in the banking and advertising business in New York.

ACTOR-GOVERNOR.—Gov. Roy J. Turner of Oklahoma, in person, played the part of Gov. Roy J. Turner in a radio program calling for his voice delivering his report as chairman of the Interstate Oil Compact Commission at the recent French Lick meeting. The semiweekly program, "Wheels of Oil," originating in Tulsa, was on the subject of conservation and quoted the Compact's report to President Truman that member states have reserve crude-producing capacity of more than 1,000,000 bbl. daily. With the governor is Ruth Sheldon Knowles, producer of the show.



SCOUT OFFICERS.—Officers of the Midland, Tex., Oil Scouts Association, who will serve during the ensuing year. Left to right: Cliff Wilderspin, Honolulu Oil Corp., president; W. W. Walker, Humble Oil & Refining Co., secretary; J. Robbins, second vice president; LeRoy J. Gibson, Magnolia Petroleum Co., first vice president; and G. B. Hallman, Mid-Continent Petroleum Corp., editor. The Midland association has 75 members representing 36 oil companies, making it one of the largest such groups in the country.

Robert M. Hunt has been appointed supervisor of lubricating oil and wax manufacture at Tide Water Associated Oil Co.'s refinery in Bayonne, N. J.

A. H. Baker has been made assistant public relations manager at the Linden, N. J., plant of Standard Oil Co. (N. J.).

James Tanham, vice president of The Texas Co. in charge of industrial and public relations, will retire on August 31. He joined the company after release from naval service at the end of World War I. Before his election in 1941 as vice president, he was assistant to the president for 8 years and prior to that time was assistant to the vice president in charge of sales.

Edward L. Steiniger has been elected president of Venezuelan Petroleum Co., succeeding **H. R. Kunhardt, Jr.,** who has been granted a leave of absence. Associated with the company since 1928, he has been executive vice president and manager of the operating subsidiary, Sinclair Oil & Refining Co.

DEATHS

David A. Carter, 54, pioneer oil man and for several years district foreman at Wewoka, Okla., for Sinclair Oil Co., died in Tulsa August 13.

James A. Cannon, 83, retired oil executive, died in Olmsted, Ill., on July 29. He served more than 50 years in the oil industry, starting out in Cleveland, Ohio, with Standard Oil Co. as an office boy at the age of 14.

Harold H. Paup, formerly with Gas Service Co., Wichita, Kans., was killed in an automobile accident near Lyndon, Kans. In recent years he headed a large construction company bearing his name. He worked with Gas Service for 10 years.

George D. Morgan, 56, oil executive, and member of the Texas State Board of Education, died in San Angelo, Tex., on August 18. At his death, he was board chairman of Cooper Oil Co. He served a 6-year term as a regent of the University of Texas.

Joseph H. Turner, Rocky Mountain division geologist with Phillips Petroleum Co., died at Bartlesville on August 14. He was formerly district geologist for the firm at Denver.

Ross James Beatty, 96, one of the first to develop natural gas fields in northern Indiana, died in Chicago August 19. He was a former vice president of Inland Steel Co.

Oscar B. Winey, 67, retired industrial sales manager for Socony-Vacuum Oil Co., died in Pittsburgh. He had completed 40 years with the company when he retired.

Fred K. Haskell, 67, retired employe of Cities Service Oil Co., Bartlesville, Okla., died in Princeton, N. J. He had come to Oklahoma from Bradford, Pa., early in the 1920s.

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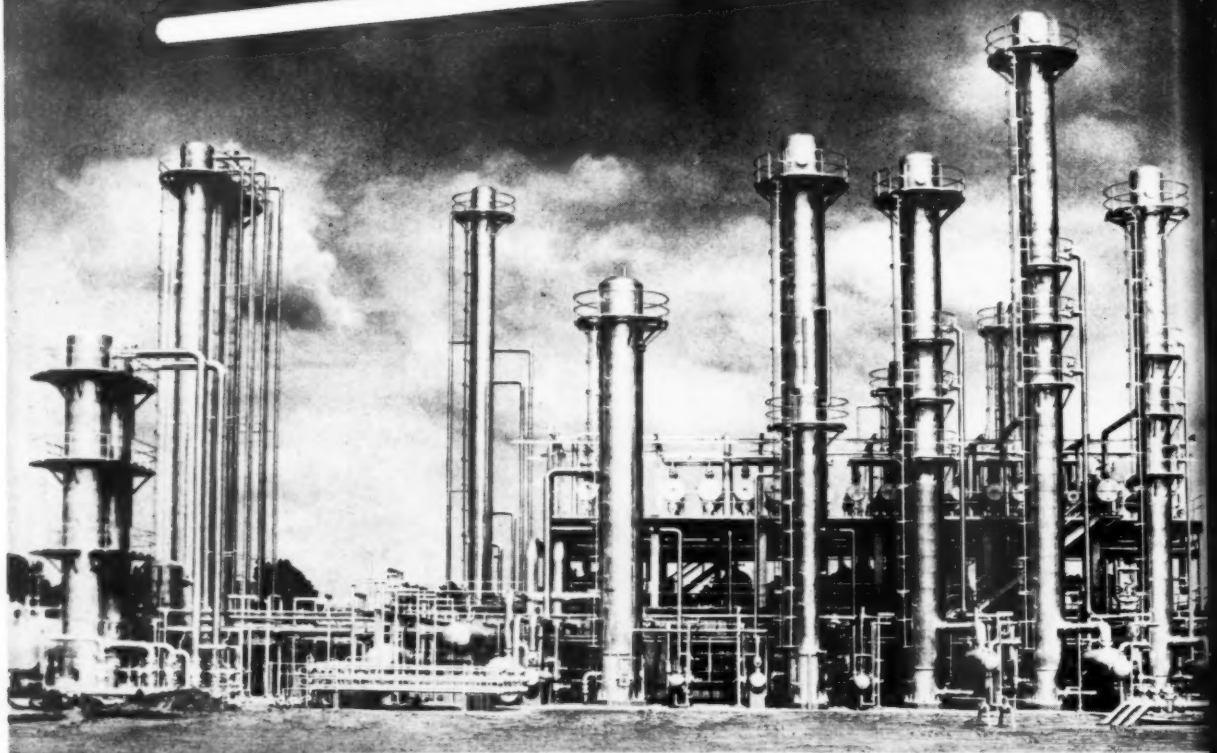
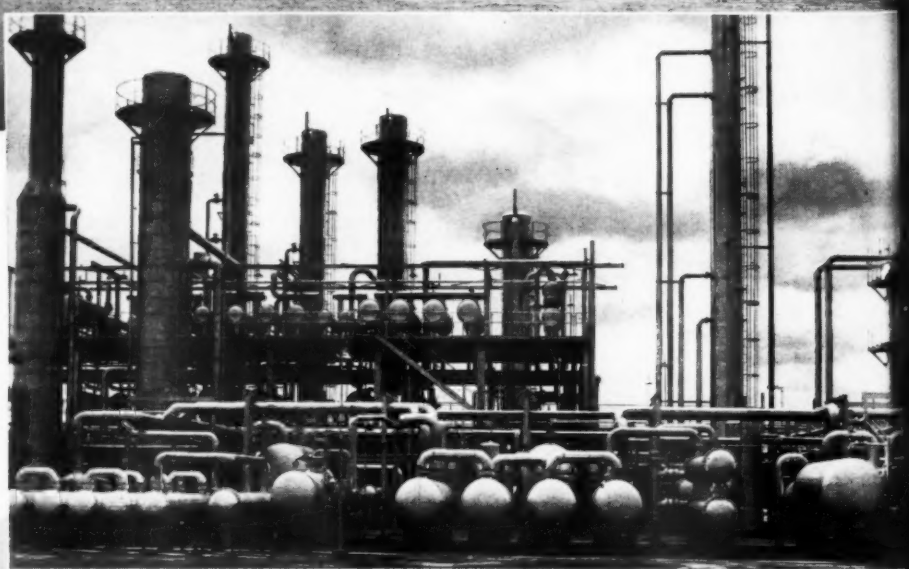
More than 100





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THE ROSTER OF G-R EQUIPMENT IN THE PLANT IS AS FOLLOWS:

- 40 Shell-and-Tube units for coolers, condensers and oil-to-oil exchangers
- 2 Steam-heated Reboilers
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Here, as in many other plants throughout the oil and gas industry, G-R Heat Transfer Apparatus has been selected because of the long G-R leadership in developing designs to meet the advancing needs of the industry, and the proven excellence of performance of G-R equipment.

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A shell-and-tube unit with many distinctive features for efficient performance with minimum attendance and maintenance expense.

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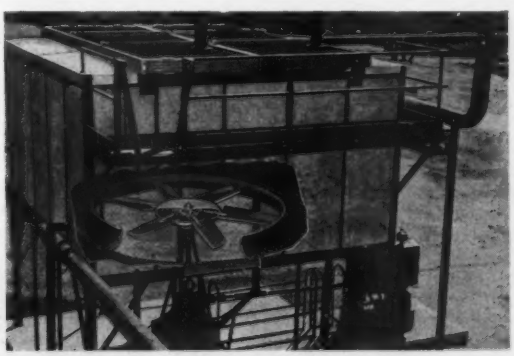
Widely used in process industries, and available with either bare tubes or K-Fin helically finned elements.



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This aerial photo indicates clearly the general over-all refinery layout. Also shown are the west and north tank farms, and boundaries defined by adjoining railroads.

MODERN LIGHT-OIL REFINERY

Completion of an extensive construction program at East St. Louis refinery of Socony-Vacuum makes this plant one of the company's most modern units of its type. Charge capacity is 30,000 bbl. per day

by H. A. Lutz* and L. L. Claassen†

SOCONY-VACUUM OIL CO., INC., has recently completed a construction program at the East St. Louis refinery making this plant one of its most modern light-oil refineries. The refinery processing units are designed to have a combined charge capacity of 30,000 bbl. per day of Mid-Continent sweet and West Texas sour crude oils.

The refinery produces gasoline, middle distillates, and coke. Over-all gasoline yields in excess of 60 per cent may be attained efficiently and assist in supplying the current high demand for automotive fuels. Houdry fixed-bed and Thermofor catalytic cracking with thermal reforming and thermal cracking of refractory stocks are employed to realize this gasoline production. Hydrofluoric acid alkylation will be used to convert the excess butane fractions to gasoline. Tannin-solutizer treating is employed to improve the odor of the gasoline and remove sulfur compounds, thus increasing the tetraethyl lead susceptibility.

Selection of the new processing units for this construction program was based on numerous economic surveys balancing the predicted market demands against utilization of existing equipment into the most flexible processing scheme possible. Existing catalytic cracking facilities were adequate for the program adopted; however, increased crude separation was required as well as replacement of thermal and coking equipment in a new combination thermal unit along with attendant gas recovery and gasoline treating. All processing units now in use in the refinery are relatively new, having been erected since 1939 with the exception of one crude tower erected in 1937 and revamped in 1949 as part of the new construction program.

Complementary to the new processing units are additional facilities for cooling water, steam, and improve and modernize primary electrical distribution system in the refinery. Replacement of truck and barge-loading facilities were required efficiently to

*Manager, technical department and †process engineer, Socony-Vacuum Oil Co., Inc., St. Louis.

handle the larger volumes of products. Approximately 1 million barrels of additional tankage has been added to increase the plant's ability to handle seasonal storage of burning oils, distillate fuels, and gasoline.

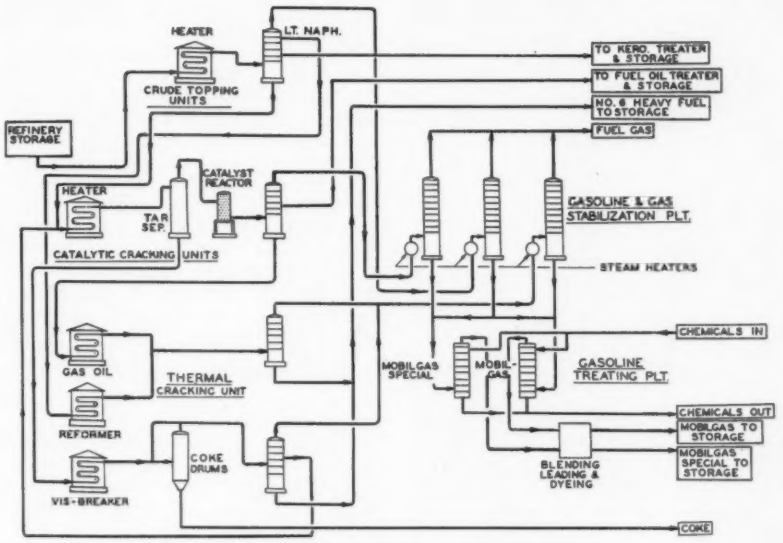
Maximum flexibility desired in a refinery processing scheme has been incorporated insofar as practical in this design. Sweet and sour crude oils may be processed. A clean gas-oil cracker allows cracking of middle distillates when market demand for them is weak. Petroleum coke or heavy fuel can be produced. The turnaround of any unit other than primary crude distillation does not cause the crude run to be altered, although a minimum of intermediate stock tankage is used. Maximum aviation-gasoline and jet-fuel production is possible on very short notice.

Refinery Plot Plan

The refinery plot plan dictated to a great extent the construction schedule for the contractor and added many hazards to those usually experienced in a construction job of this magnitude. The refinery proper is bounded by railroads and confined to an area of 19 acres. Included in this area are all the operating units, shops, offices, and truck and tank-car loading facilities. All new facilities were added to the refinery without discounting operation. This required dismantling obsolete equipment, preparation of job sites within operating areas, and the close scheduling of unit tieins for continuous operation. The successful completion of this program without mishap was possible only by the wholehearted cooperation of the refinery operating and maintenance personnel and that of the contractor.

Two crude-fractionating units permit concurrent processing of sweet and sour crude oil from refinery storage. A new crude unit was constructed to produce straightrun gasoline with a 90 per cent point of 270° F., a light naphtha cut for thermal reformer charge stock, kerosine, and topped crude. The new crude unit was designed for sour crude and employs an alloy clad fractionating tower. The existing crude unit was revamped and modernized to produce similar products from sweet crude. A new 17,000-bbl. per day chemical and electric desalter was added to treat crude for either crude unit. Normally, the desalter is operated with the new crude unit when it is charging sour crude.

The Houdry fixed-bed and T.C.C. units receive as charge stock topped crude from the crude units and coker or vis-breaker gas oil from the new thermal unit. The high-sulfur charge stocks are segregated for handling at the T.C.C. unit leaving relatively sweet stock for the Houdry fixed-bed charge. A new debutanizer was added to the existing catalytic gas



Flow chart of East St. Louis refinery.

recovery and stabilization unit, making possible separation of catalytic gasolines prior to continuous blending before charging to the new tanninsolutizer gasoline-treating unit. Stabilized gasoline produced from the catalytic units, together with alkylate, are the high-octane components in finished gasolines. Catalytic distillates are blended with straightrun naphtha to produce diesel fuel and home-heating oils. The small quantity of cyclic refractory stock furnishes a portion of the charge to the new clean gas-oil thermal cracking section. Tar from catalytic feed preparation is charged to the delayed coker section of the thermal unit.

The new thermal unit includes three separate furnaces, two main fractionators, delayed coking drums, and a complete gas plant. The combined charge capacity for this unit is 13,000 bbl. per day, producing a B-B fraction, debutanized gasoline, coker gas oil, and coke. The coke section of this unit, if desired, can be operated as a vis-breaker. This entire unit is centrally controlled from one control room and is designed so that the coker or the thermal section can be down for a turnaround without interrupting the operation of the other section of the unit.

Alloy equipment is employed in the towers, furnaces, and some lines. Newly designed combustion-control equipment was installed on the new furnaces. This included oxygen-recording equipment on the flue gases, mechanically controlled dampers, and air register controls on the burners to maintain fire-box drafts and specified oxygen percentages in the flue gases.

The thermal section of this unit

New coke unit, with the water-recovery equipment and blowdown tank in foreground. To the right of coking unit is fractionating equipment for the thermal unit. The two crude-fractionating towers are to left of the coke structure.

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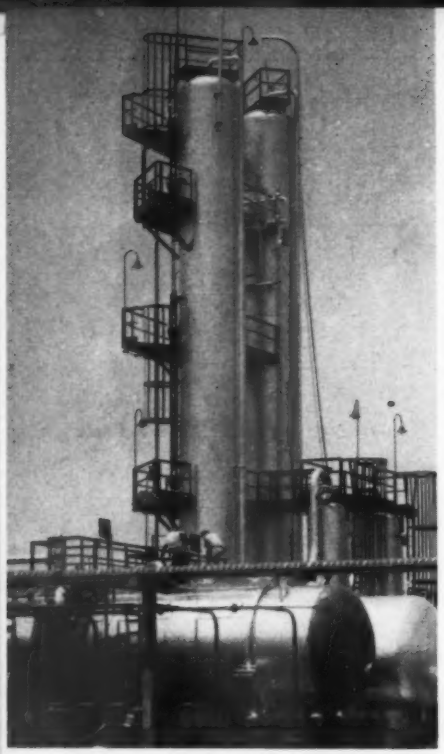


View of the two solutizer contact towers, with solution settling tank in foreground.

consists of a naphtha-reformer coil and a clean gas-oil cracking coil utilizing a common fractionating tower. The gas-recovery and stabilization equipment is common to the thermal and coker sections of the unit.

The coker section consists of a furnace, two delayed coke drums, and a separate fractionator. With only a small change to the furnace transfer line, the coke drums can be bypassed and the unit operated as a vis-breaker; thus, operation permitting the production of either petroleum coke or fuel oil is possible, depending upon market requirements and other factors. When coke is produced, net No. 6 fuel production for the refinery is less than 6 per cent of the crude processed. The plot area available for the coker section of the thermal unit necessitated locating the water-recovery equipment and blowdown tank common to this type unit in a tank-farm area separated from the refinery by a railroad. Underground lines connect this equipment with the unit proper. The unit is operated on a conventional two-drum, 24-hour cycle with hydraulic decoking of one drum per day. The unit produces up to 250 tons of coke per day. This coke is loaded directly from the coke drums into railroad cars and moved from the refinery to the marketing distributor.

The hydrofluoric acid alkylation unit, built during the war, is presently being revamped and rehabilitated, benefiting from improvements developed in the process by Socony-Vacuum on HF units in its other refineries and research and development laboratories.

As part of the rehabilitation program for the alkylation unit, all B-B storage has been removed from the refinery area proper and relocated on new property acquired east of the refinery. A remaining portion of this property is utilized by finished-product tankage. Location of refinery storage makes necessary both underground and overhead pipe alleys across railroad to tankage. All interconnecting process piping within the refinery is carried on overhead pipe racks.

Gasoline-Treating Plant

The new gasoline-treating plant consists of two parallel tannin-solutizer treater units for the chemical removal of sulfur compounds. Each unit is designed for a treating capacity of 10,000 bbl. per day. The gasoline is first caustic washed and then contacted countercurrently in tray towers with the solutizer solution. Spent solution is regenerated in a common system and returned to both units. Blending of catalytic, thermal, and straightrun-gasoline components is accomplished prior to treating. Treated gasoline of specification mercaptan content and reduced total sulfur content is leaded and blended with butane from the alkylation unit. Normal operation calls for one blended stream to be treated for "Mobilgas Special" with the other gasoline stocks being blended together and treated for "Mobilgas." Blocked operation allows treating specially blended streams such as may be required for jet fuels or other special purpose products.

Construction of the gasoline-treating unit made idle existing equipment which is being revamped into a continuous kerosine treater. This unit will increase kerosine-treating capacity and make possible the abandoning of present batch agitators which in addition to being inefficient at the high throughputs required have deteriorated beyond the point of reasonable repair.

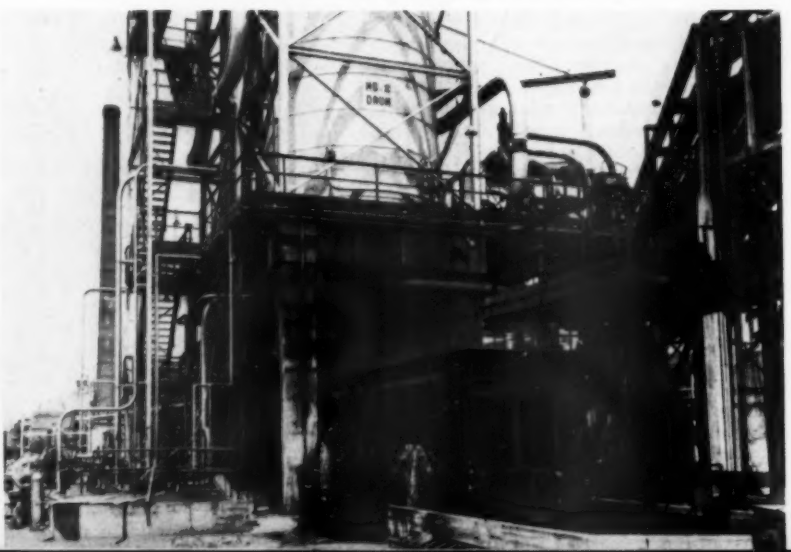
The final unit to be completed in the recent construction program was placed on stream in April of this year. Operation of the refinery since this period has indicated that physical layout and design of the refinery and units have many merits. Initial operation of the new equipment has presented new problems of control and unit coordination which are rapidly being worked out as refinery personnel become familiar with the equipment and its operation. In a refinery as compact as this, many oil streams exchange heat with other units and unit charge streams in some cases do not pass through intermediate tankage from one operation to another.

Refinery tankage is divided into three separate farms. The west tank farm handles primarily unit charge stocks and intermediate processing oil with all primary unit charge pumps located in this area. The north tank farm handles finished products for the truck and tank-car loading as well as all intermediate blending stocks and blending tanks. The east tank farm is utilized for finished product storage.

Crude oil is delivered to the refinery by a single pipe line, and the sweet and sour crude oils are segregated into four storage tanks. The crude unit charge pumps are located in the west tank farm and supply crude at sufficient pressure to be manifolded at the crude unit for circulation through heat exchange at the catalytic units before being returned directly to the crude-fractionating towers. Crude-unit operators control all crude rates and changes in heat exchange streams must be coordinated between these independent units. The crude-unit heaters supplement this heat supply and act as

(Continued on page 173)

Here is the bottom of the coking unit during the hydraulic decoking of No. 2 coke drum, showing method of loading directly into railway cars.



by J. A. Perkins, Jr.

COMPLETION AND PRODUCTION TECHNIQUES IN *Unconsolidated Sands*

BEFORE going into the details of the completion and production techniques, it may be pertinent to look into this matter of unconsolidated sands. Although the author can boast of no statistical data, it is believed highly probable that most if not all virgin sand reservoirs are in a consolidated state when penetrated by the bit for the first time. Now if this theory generally is accepted, a hypothetical case may be constructed. This is represented by Fig. 1 in which is shown 5½-in., J-55, 15.50-lb. casing set and cemented through a consolidated sand.

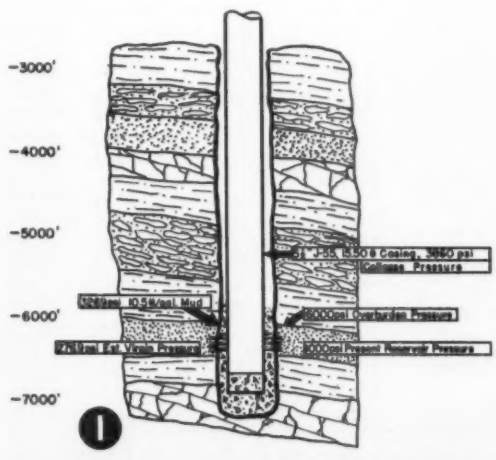
The sand is assumed to be at a depth of 6,000 ft., and 10.5-lb. per gal. mud was used during drilling operations. The estimated virgin-reservoir pressure was calculated to be 2,769 psi. The gradient used for this calculation was 0.4615 lb. per sq. in. per ft. and is considered to be reliable for Gulf-Coast applications. The overburden pressure at the sand was calculated to be 6,000 psi., and the gradient used was 1 lb. per sq. in. per ft., which is also acceptable for Gulf-Coast application.

The subject reservoir is now assumed to have been produced until the pressure has decreased to 1,000 psi. This means that as a result of withdrawals, we have created a differential between the producing reservoir and the overlying beds which may be of considerable magnitude, and in this particular case could be as high as 5,000 psi. Should such a differential occur, there is doubt that the cementing material would have sufficient compressive strength to withstand the pressure brought to bear. This becomes more evident when it is remembered that most of the cementing material in these sands is usually some type of clay or is calcareous in texture.

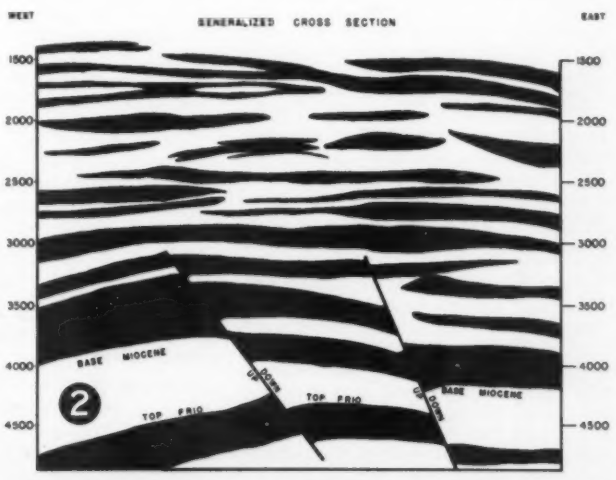
J. A. Perkins, Jr., is assistant chief petroleum engineer, Houston district, Gulf Oil Corp. He was promoted to this capacity May 1, 1948, after having served in various classifications since November 29, 1934, at which time he joined the Gulf organization as a roustabout. Perkins received his B.S. degree in Petroleum Engineering from Louisiana State University in 1934.

A very slight down movement of the overburden would be sufficient to destroy the cementing material and of course the result would be an "unconsolidated sand." This condition would then permit lateral migration of the sand to the bore of the well both as a result of pressure from the overlying beds and as a function of the velocity of the produced fluids. Should the well be permitted to continue the production of sand for any appreciable time, we then would have to assume that a "cavity" is in the making, as it would be difficult to imagine that perfect synchronization between the downtravel of the overlying beds and the lateral movement of the sand could be effected.

It is believed that with continued enlargement, the cavity would reach proportions which could conceivably induce localized faulting causing the beds above to drop suddenly. Should this happen, a terrific pressure, as high as 6,000 psi. in this case, may suddenly be applied to the cased hole and usually with devastating effect. As depicted in the figure, casing of this type normally used for this depth has a collapse pressure of 3,860 psi.



1—Pressure conditions pertaining to casing, drilling mud, overburden, and producing reservoir.



2—Goose Creek field has many lenticular Miocene and Frio sand sections which overlap. Some are faulted.

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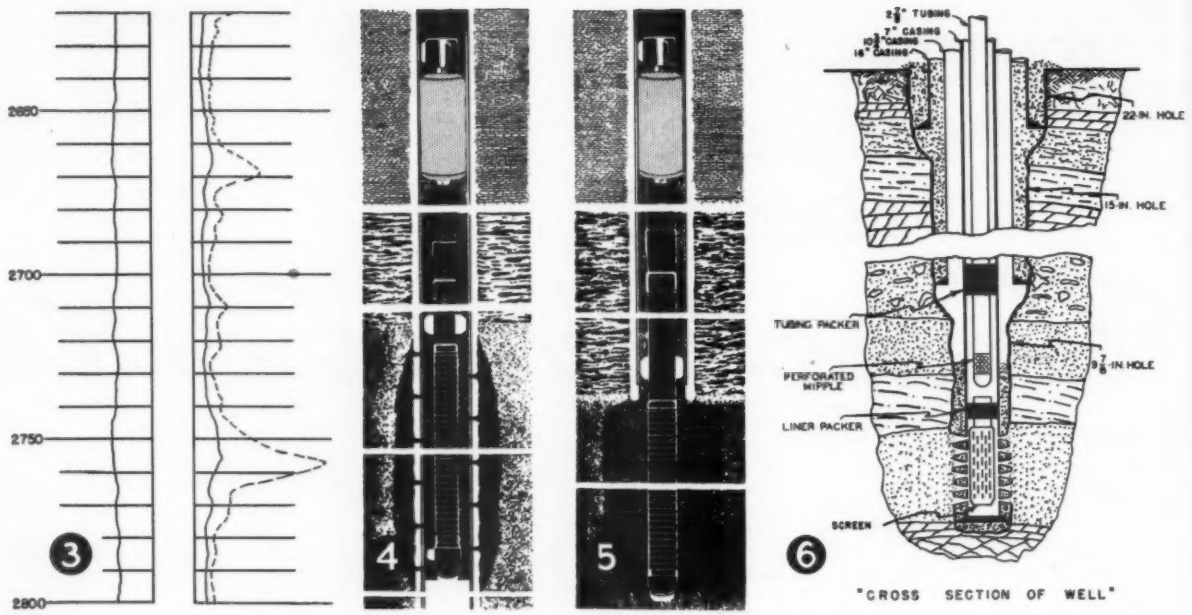

3—Electrical log of Goose Creek well. 4—Method for gravel packing a well through perforated casing. 5—Gravel-packing method applied to open-hole completion. 6—Schematic diagram of well completion at Goose Creek, with 7-in. casing set and cemented through productive horizons.

It is needless to say that a condition such as described would result in a collapsed casing. There are many examples in actual operations where such a condition must have occurred, as the tubing was found filled solid with sand for as much as 5,000 ft. when the known bottom-hole pressure was about 930 psi.—a pressure much too low to support a column of sand of that magnitude.

Of course on the other hand there is the possibility that the cavity may approach a limited size thereby affording a fluid buffer between the reservoir rock and the cased hole. This would in effect tend to reduce the adverse effect of the velocity of produced fluids in the reservoir, and by assuming that the overlying beds are of a competent nature, no further sand troubles would be experienced. It is the writer's opinion that this condition is more of an exception than the general rule.

There are other ways for sands to become "unconsolidated"; such as solution of the cementing material due to the passage of produced fluids, excessive squeeze pressures, etc. These will not be discussed, as it is believed the basic idea is portrayed sufficiently by the first example.

Completion and production techniques in unconsolidated sands have never been standardized for a number of very good reasons. The factors which influence the plan of completion are many and for the most part very complex. It is not the intention of this paper to cover in detail all of the variations in completion and production techniques but rather to cover the techniques generally used at the present time.

Goose Creek Field Problem

The Goose Creek, Texas, field has been selected as a representative example of a field in which shallow drilling is now in progress in the development of the so-called unconsolidated sands. The field was discovered in 1908 and has a surface area of approximately 1,400 acres upon which some 1,000 wells have been drilled. Production is derived from the many reservoirs occurring in the Miocene and Frio sections. The faulting and lenticularity of the sands in the Miocene section exist to such a high degree that all efforts at mapping thus far have resulted in failure.

By referring to the generalized east-west cross section of the field, Fig. 2, some idea of the complexity of reservoir occurrence is gained. To complicate matters further, the sands are highly stratified with clays. Minor faulting with the displacement being measured in inches mismatches even these very thin, permeable-sand layers. Fig. 3 shows the electrical resistivity log of this same section.

Many sieve analyses of the unconsolidated sands have been made, and Table 1 represents what is considered to be an average condition. It will be noted that the grain size is so small that over 50 per cent of the sample passed through, and less than 25 per cent was retained on a 100-mesh screen.

Casing Methods; Unconsolidated Sands

Practically every type of combination of types of reservoir-drive mechanism can be found in the shallow, unconsolidated-sand reservoirs of the Gulf Coast.

Basically, there are two methods of casing a well preparatory to producing an unconsolidated-sand section. One method would be to set casing above the intended producing section and make a completion below in open hole with the use of a screen or some consolidating material for impounding the sand. The other method of course would be to set and cement casing through the intended producing section, or sections, and selectively perforate for production using an arrangement within the bore of the casing for impounding the sand. Due primarily to economics, the latter method is more extensively used as there usually exist several reservoirs having a potential of commercial production.

Fig. 4 shows a method for gravel packing a well through perforated casing, and Fig. 5 shows the process in open hole. The gravel is placed into position by pressure applications which are repeated until the reservoir's capacity to receive is reached. A screen is then washed down through the gravel pack and is sealed to the casing above.

Another method is to place the gravel after the screen is set. The well is then ready for production. It is very doubtful that the placement of the gravel approaches any such degree of regularity as is indicated by the figures just referred to; however, the basic idea is implied. Experience with "gravel packing" in the past has been more or less disappointing, but with this new approach of placement with pressure, higher percentages of success may be expected.

Sand consolidating plastics have

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John Maher

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been used in the past with varying degrees of success, which as a whole have not been high enough to warrant any extensive use of this method. The failures for the most part seemed attributable to the operators' inability to place the plastic where it was needed. It is the author's opinion that due to the variable permeability existing in any one sand body, it is physically impossible to sand consolidate a section in one operation. It is believed that the permeabilities of the various sand layers in any one section would have to be reduced to a common denominator so to speak, and this can be done only by multiple stages or by selective application by mechanical means.

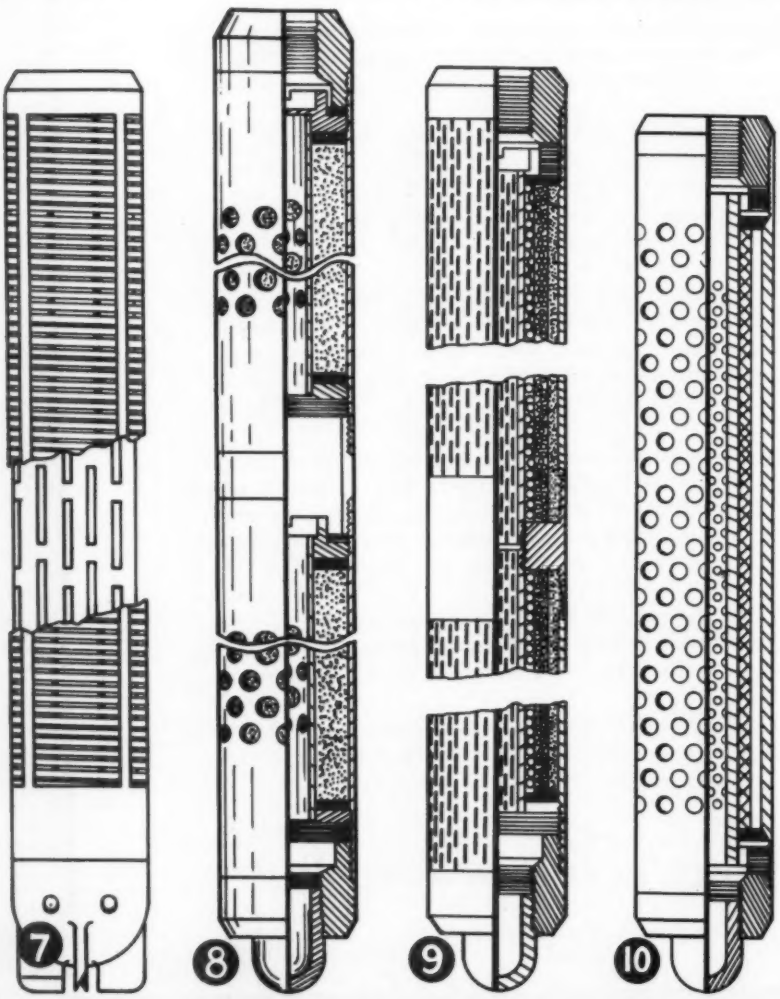
A disadvantage of this type job is that the sand when consolidated with plastic has a compressive strength of from 500 to 600 psi. Therefore, the selection of reservoirs for this application must be made where bottom-hole pressures are expected to be relatively high during the productive life of the well.

Fig. 6 is a schematic diagram of a well at Goose Creek. It will be noted that the oil string is 7-in. o.d. casing and is set and cemented through the possible productive horizons. Although not shown in the diagram, scratchers and centralizers are standard equipment. The lowermost sand is opened for production by jet perforating the casing and the cement sheath existing in the annulus and the bore of the drilled hole. An "inside screen" is shown to be set adjacent to the perforated section with a liner packer sealing the screen to the 7-in. casing above the perforated interval.

There are several types of "inside screens" being used today. Fig. 7 shows a cut of the conventional wire-wrapped screen which has been in use for many years both in open hole and in perforated casing. This screen is constructed by wrapping a wedged-shaped wire around steel pipe which has been slotted. The space between the wraps is adjusted so as to give the desired mesh or gage opening. Generally, this type of screen gives satisfactory service so long as the openings are not decreased below 60 mesh. There is one serious disadvantage in that the screen is not constructed of drillable materials, and cleanout jobs are often very expensive.

Fig. 8 shows the permeable plastic screen. This screen is usually constructed in 5-ft. lengths which may be connected together by cast-iron adapters and is drillable in its entirety. The screening medium is a permeable plastic which is encased in brass sleeves that have been perforated.

The screen has a permeability of approximately 10,000 mds. and will screen out sand grains retained on a 200-mesh screen. The maximum safe differential pressure is placed at 1,500 psi. The main disadvantage is that only small amounts of drilling mud will plug the screen, making it unfit for further service. Another disadvantage is that the screen is relatively fragile and requires special care while being installed so as not to damage the plastic.



7—Diagram of conventional wire-wrapped screen. 8—Arrangement of permeable plastic screen. 9—Sketch of permeable-beaded screen (experimental). 10—Experimental screen which utilizes a porous bronze sleeve as screening medium (crosshatched area).

Glass Beads for Screening

Fig. 9 is a sketch of what we refer to as the permeable-beaded screen. This is an experimental screen designed by the writer and utilizes glass beads for the screening medium. These glass beads are encased in two concentrical brass sleeves having vertical slotting. There are three bead sizes used, and they are so arranged that they grade in size from small to large from the outside to the inside of the pack. The sections are made in 5-ft. lengths and may be connected to each other by cast-iron adapters if needed. The entire assembly is drillable. One such screen has been installed and is giving satisfactory service.

Fig. 10 is a sketch of an experimental screen utilizing a porous bronze sleeve as the screening medium and is represented on the sketch as the crosshatched area. This bronze sleeve is made by fusing tiny bronze spheres together and is approximately ¼ in. thick. It is encased within two brass sleeves which are perforated. The entire assembly is drillable.

Referring again to Fig. 6, we see the tubing which is immediately above the liner packer and unattached thereto. The tubing is shown sealed to the 7-in. casing by means of a conventional hook-wall packer. The sequence of operations leading up to such an arrangement as that just described is as follows: After the well has been drilled and the oil string set and cemented, the drilling mud is displaced with salt water. The salt water used for this purpose is usually obtained from the lease gunbarrel and, if necessary, is weighted up by the addition of rock salt. Weights as high as 10 lb. per

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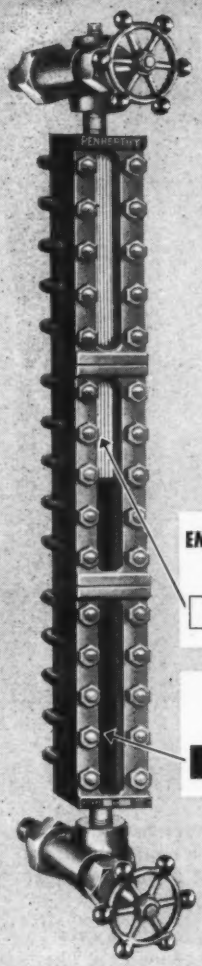

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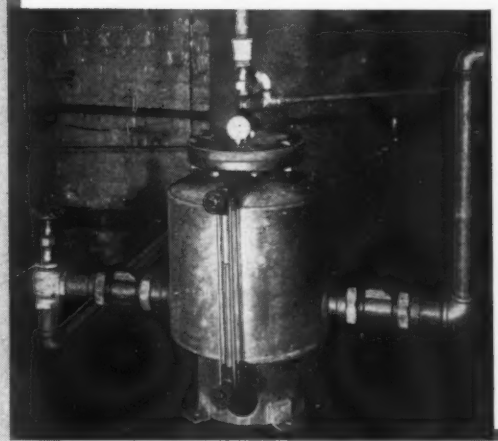

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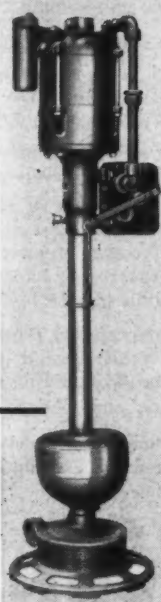

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gal. may be achieved in this manner.

Also added to the salt water is a chemical tracer dye. The dye being used for this purpose at present is fluorescein, and it imparts to the water a greenish-yellow color. This tracer is helpful when it becomes necessary to distinguish between formation water and drill fluid lost to the formation during operations. Special effort is made to keep an accurate daily record of the volume of salt water lost to the formation during operations. This serves as an additional check on whether or not the water being produced is formation water. When the displacement of the drilling mud with salt water is completed, the well is then perforated for production; the tubing is run; the packer is set; and the well swabbed to establish natural flow.

The well is then permitted to produce at its assigned calendar-day allowable rate until it "sands up." The time usually required for this to occur is anywhere from 2 weeks to a couple of months. During this time the drilling rig has been moved off, and a small inexpensive tubing hoist is moved in for the remedial work.

Sand Washed Out

The well is then circulated with salt water with a tracer added, and the sand is washed out—usually by reverse circulation. Invariably, considerable quantities of drilling mud are washed out with the sand, and whenever this condition is found to exist, the well is "sanded up" again either by swabbing or by the use of a perforation washer. This is repeated until no further evidence of drill mud is found. The inside screen is then installed adjacent to the perforated interval and is sealed to the casing above with a liner packer having holdup-holddown slips.

Experience has shown that these shallow sands are invaded or contaminated and in some unexplainable manner harbor appreciable quantities of drilling mud for quite some time after production has been established. This is evidenced by the fact that some of the wells have produced clean oil for as many as 30 days, after which time 15 to 20 bbl. of drilling mud have been produced. Naturally when the sieve analysis of the sand dictates that a 100 or 200 mesh screen be used, the subsequent production of drill mud is disastrous to the setting. Therefore we believe that it is prudent to "clean up" the sand prior to setting a screen of any type, and the results being obtained in the field substantiate this belief.

"Pumping In"

Upon completion of setting the screen, the well is equipped to pump and is subsequently "pumped in." Primarily, the "pumping in" idea is prompted by economics, as substantial quantities of salt water are generally lost to the formation during clean out operations. The cost of producing this water by swabbing is usually prohibitive. In addition to the desirable financial aspects of this policy, there also exists the belief that a slow, steady, withdrawal of the reservoir fluids is most desirable and minimizes the possibility of damaging the screen by creating large differential pressure across it as would be the case when swabbing.

During the producing life of the well, care is taken to insure as constant a rate of withdrawal as practicable. The magnitude of this withdrawal, within reasonable limits, does not seem to be important in regard to screen service so long as it is more or less constant. A few of the arrangements now being used to insure steady rates of production are 24-hour operation, bottom-hole chokes, top-hole chokes, and the utilization of back-pressure regulators on the flow line.

TABLE 1—SIEVE ANALYSIS—GAILLIARD FEE NO. 22
(From 1,868 to 1,876 ft., Miocene sand)

Caught on 40 mesh screen	A few grains
Caught on 50 mesh screen	.07%
Caught on 60 mesh screen	.41%
Caught on 70 mesh screen	2.80%
Caught on 80 mesh screen	15.65%
Caught on 100 mesh screen	23.40%
Caught on pan	57.67%

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Relations Between Resistivities and Fluid Contents of porous rocks

by Dr. Leendert de Witte*

This paper represents the results of theoretical and experimental studies on the factors determining the resistivities of porous rocks. These factors are: the resistivity of the interstitial water, the formation factor, the water saturation, and finally the amount and resistivity of conductive solids present in the rock.

The current conduction by the combination of the randomly distributed conductive solids and the interstitial water is represented as being the equivalent of the current conduction by a mud slurry contained in an inert porous medium. The formation factor then is defined as the ratio of the over-all resistivity of the rock to the theoretically computed resistivity of the "slurry." Based on this conception, formulas have been worked out for the resistivity of water sands and of oil or gas sands. The resistivity formulas for partially oil-saturated sands represent a generalization of Archie's formula which neglects the presence of conductive solids.

Experimental data are given in support of some of the assumptions made in this analysis. The final formulas seem to be in satisfactorily close agreement with experimental results.

Introduction

THE first formulation of relations between resistivities and fluid contents were given by Archie.[1]

Archie's formulas may be expressed by:

$$R_o = F R_w \quad (1)$$

and

$$S_w = (R/R_o)^{1/n} \quad (2)$$

Here R_o is the resistivity of the rock 100 per cent saturated with an electrolyte of resistivity R_w. Equation 2 applies to a partly oil-saturated rock of resistivity R. S_w is the water saturation expressed as a fraction of the total pore space. Archie found $n \sim 2$.

Patnode and Wyllie,[2] who introduced the concept of current conduction by conductive solids in most reservoir rocks, showed that Archie's formulas are only valid where the presence of conductive solids may be neglected. The same authors presented alternative equations for water sands and indicated the effects of the presence of conductive solids in the application of Equation 2.

This paper attempts to present a theory on the current conduction in porous rocks leading to generalized formulas applicable in all cases.

Archie's formulas are shown to represent special cases of the general equations, and conditions for the limits of application of those formulas are indicated.

Resistivity of Water Sands

The resistivity of a 100 per cent water-saturated sandstone was expressed by Patnode and Wyllie[2] in the form:

$$\frac{1}{R_o} = \frac{1}{\rho_t} + \frac{1}{\rho_w} = \frac{1}{\rho_t} + \frac{1}{FR_w} \quad (3)$$

here ρ_t equals the resistivity of the conductive solids, as distributed, and ρ_w the resistivity of the water as distributed. $\rho_w = FR_w$ where R_w is the "bulk" water resistivity and F the formation factor, which would be found if none of the solids were conductive.

Equation 3 implies that the water-saturated rock has an equivalent circuit consisting of two parallel resistances, one representing the resistance of the water phase and the other equal to the total resistance of the conductive solids as distributed.

Physically this would be true if the water and conductive solids were electrically insulated one from the other and both offered a continuous path for the current. This is not the case in a water-saturated sandstone. On the contrary, the conductive solids and the water are everywhere in contact with each other and petrographic studies of thin sections of sandstones strongly suggest that in general the conductive solids do not form continuous layers or films over the sand grains but occur mostly in isolated small quantities randomly distributed throughout the rock.

Patnode and Wyllie proved that if the unknowns of Equation 3, F and ρ_t, were resolved from two measurements of R_o for corresponding values of R_w, one could calculate R_o for any other arbitrary value of R_w. The calculated R_o's were compared with measured values and a very good agreement was obtained. This was taken by Patnode and Wyllie as a proof that Equation 3 correctly represents the current conduction through water-saturated sandstones. Actually the above results only show that the conductivity of a water sand may be represented by an equation of the type $1/R_o = z + (y/R_w)$. The experiments of Patnode and Wyllie give us no conclusive information regarding the quantities z and y.

The same authors studied the behavior of mud slurries with regard to current conduction and found the empirical formula:

$$\frac{1}{R} = \frac{N^x}{R_t}(1 - 1/F) + \frac{1}{FR_w} \quad (4)$$

where R_t = the bulk resistivity of the conductive solids, N = the fraction of conductive solids by volume, and $x \sim 1$.

This again is of the type $1/R = z + (y/R_w)$.

It was also found that for slurries containing only conductive solids, there is a linear relationship between the percentage of solids $(1 - P)$ and the conductivity of the solid phase $(1/\rho_t)$. Here P denotes the volume fraction of water which is equivalent to the porosity in the case of a water sand.

This suggests that a homogeneous mixture of conductive solids and an electrolyte behaves exactly as a mixture of two electrolytes. For the latter the resistivity is given by the expression:

$$\frac{1}{R_c} = \frac{X_1}{R_1} + \frac{X_2}{R_2}$$

(See Reference 3)

Applying this formula to a mixture of conductive solids and water we obtain:

$$\frac{1}{R_c} = \frac{X_t}{R_t} + \frac{X_w}{R_w} = \frac{1 - X_w}{R_t} + \frac{X_w}{R_w}$$

where X_t and X_w are the volume

*California Institute of Technology, Pasadena. This is a publication of Division of the Geological Sciences; contribution No. 556.

fractions of the conductive solids and the water, respectively.

Rearranging gives:

$$R_o = \frac{R_w R_t}{R_w - X_w (R_w - R_t)} \quad (5)$$

It seems reasonable to assume that the combination of randomly distributed conductive particles and water in a sandstone behaves the same with respect to current conduction as a slurry made up of the same amount of similar conductive solids and water.

The resistivity in the rock is then equal to F times the resistivity of the slurry (or the equivalent combination of conductive solids and water). Here F must be defined as the formation factor which we would find if the conductive solids were replaced by water of the same type as that occupying the pore space.

The over-all resistivity of the rock now becomes:

$$R_o = FR_e = \frac{FR_w R_t}{R_w - X_w (R_w - R_t)}$$

$$= \frac{FR_w R_t}{(1 - X_w) R_w + X_w R_t} \quad (6)$$

Letting $FR_t = \delta$; $X_w R_t = m$ and $1 - X_w = X_t = n$ we have:

$$R_o = \frac{\delta R_w}{nR_w + m} \text{ or } \frac{1}{R_o} = \frac{n}{\delta} + \frac{m}{\delta R_w}$$

$$= \frac{1 - X_w}{FR_t} + \frac{X_w}{FR_w} \quad (7)$$

We see that Equation 7 again is of the form $1/R_o = z + (y/R_w)$ and therefore agrees with the experimental results of Patnode and Wyllie.

Moreover, Equation 7 is also applicable to slurries containing both conductive and nonconductive solids. F then represents the effect of the nonconductive solids on the resistivity of the system.

Patnode[4] found that for slurries which contain only solids of high resistivity (essentially nonconductive solids) the empirical relation $F = P^{-1.8}$ exists where P is the volume fraction of water.

Assuming that the combination of conductive solids and water is equivalent to that of an electrolyte mixture, this same relation should hold also for slurries and rocks containing conductive solids, if F is defined as for Equation 6.

If we have two values of R_o for two corresponding values of R_w we may solve Equation 7 for the two unknown quantities $(1 - X_w)/FR_t$ and X_w/F.

The resulting expressions for these quantities will be the same as those found by Patnode and Wyllie for $1/p_t$ and $1/F$.

We find:

$$\frac{X_w}{F} = \frac{(R_w)_1 (R_w)_2 [(R_o)_1 - (R_o)_2]}{(R_o)_1 (R_o)_2 [(R_w)_1 - (R_w)_2]} \quad (8)$$

and

$$\frac{1 - X_w}{FR_t} = \frac{(R_w)_1 (R_o)_2 - (R_w)_1 (R_o)_2}{(R_o)_1 (R_o)_2 [(R_w)_1 - (R_w)_2]} \quad (9)$$

where $(R_o)_1$ and $(R_o)_2$ are the resistivities of the sandstone completely saturated with water respectively of a resistivity $(R_w)_1$ and $(R_w)_2$.

Once X_w/F and $(1 - X_w)/FR_t$ are determined, we can calculate any value of R_o resulting for any water resistivity, R_w or vice versa. In all the above expressions X_w is the volume fraction of water in the combination of conductive solids and water. Similarly $1 - X_w = X_t$ is the volume fraction of conductive solids.

If P_t denotes the amount of conductive solids as a fraction of the total rock volume we then may write:

$$X_w = \frac{P}{P + P_t} = \frac{1}{1 + p_t}$$

where

$$p_t = P_t/P$$

and

$$X_t = 1 - X_w = \frac{P_t}{P + P_t}$$

From $\delta = FR_t$; $m = X_w R_t$ and $n =$

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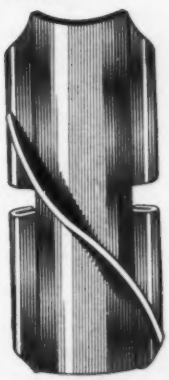

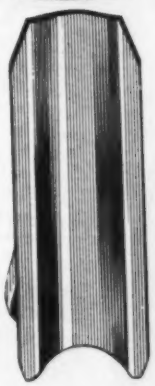

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$1 - X_w$ we find another expression for X_w, namely:

$$X_w = \frac{m/n}{R_r + m/n} = \frac{N}{R_r + N}$$

$$\text{with } m/n \equiv N \qquad (10)$$

N may be computed from Equations 8 and 9 as:

$$N = \frac{(R_w)_1 (R_w)_2 [(R_o)_1 - (R_o)_2]}{(R_w)_1 (R_o)_2 - (R_w)_2 (R_o)_1} \qquad (11)$$

Two experimental checks were made of the above formulas.

1. Saugus sandstone:

$K = 5.32$ m darcies
$(R_w)_1 = 12.3\ \Omega$ cm.
$(R_w)_2 = 156{,}300\ \Omega$ cm.
$P = 11.15$ per cent
$(R_o)_1 = 549\ \Omega$ cm.
$(R_o)_2 = 4{,}025\ \Omega$ cm.

$$\frac{1 - X_w}{FR_r} = \frac{12.3 \times 4{,}025 - 156{,}300 \times 549}{549 \times 4{,}025\ (12.3 - 156{,}300)}$$

$$= 0.248 \times 10^{-3}$$

Similarly $X_w/F = 0.0193$; $F/X_w = 51.8$

This gives:

$$\frac{1}{R_o} = 0.248 \times 10^{-3} + \frac{0.0193}{R_w}$$

For $(R_w)_3 = 342.7$ we obtain: $(R_o)_3 = 3{,}283\ \Omega$ cm.

The measured value was $(R_o)_3 = 3{,}230\ \Omega$ cm.

2. Modelo shaly sand:

$K = 1.47$ m darcies
$(R_w)_1 = 11.9\ \Omega$ cm.
$(R_w)_2 = 1{,}024\ \Omega$ cm.
$P = 15.04$ per cent
$(R_o)_1 = 367.7\ \Omega$ cm.
$(R_o)_2 = 3{,}876\ \Omega$ cm.

$(1 - X_w)/FR_r = 0.32 \times 10^{-3}$; $X_w/F = 0.0286$, so that $1/R = 0.32 \times 10^{-3} + 0.0286/R_w$.

For $(R_w)_3 = 106.6\ \Omega$ cm. we find $(R_o)_3 = 1{,}700\ \Omega$ cm.

The measured value was $(R_o)_3 = 1{,}646\ \Omega$ cm.

As stated before, the experiments of Patnode and Wyllie, carried out on a much larger scale, all verify the validity of a relation of the type:

$$1/R_o = z\ (y/R_w)$$

for the case of water sands.

If the connate-water salinity is high, we may in many cases neglect the influence of the conductive solids on the resistivity of the rock.

A criterion as to whether or not the effect of the conductive solids may be neglected can be established in the following manner:

If in the equation:

$$\frac{1}{R_o} = \frac{1 - X_w}{FR_r} + \frac{X_w}{FR_w}$$

we have $(1 - X_w)/FR_r < 0.02\ X_w/FR_w$, then the error induced in the computation of R_o by neglecting the influence of the conductive solids will be less than 2 per cent, which is within the usually permissible limits.

With $m = X_w R_r$; $n = 1 - X_w$, and $m/n = N$ we may rewrite the above condition as:

$$1 - X_w < \frac{0.02\ R_r X_w}{R_w}$$

$$\text{or } R_w < 0.02\ N \qquad (12)$$

In general we can state that the effect of the conductive solids on the resistivity of a porous rock will be small if

$$R_w << N \qquad (13)$$

If relation Equation 13 holds true, the resistivity of a 100 per cent water-saturated sandstone may be simply represented by the conventional equation:

$$R_o = FR_w$$

If we measure the resistivities $(R_o)_1$ and $(R_o)_2$ of a sample saturated respectively with solutions of resistivity $(R_w)_1$ and $(R_w)_2$, with $(R_w)_2 << N$, and $(R_w)_1 < (R_w)_2$, we may develop the following derivation:

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Baash-Ross News

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OUR 30th YEAR

You buy just 1 block ... It does the work of 3

For those small block jobs, here's the most sensible investment you can make–

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Although in average drilling and producing operations there are dozens of different jobs that call for small blocks, you can reduce them all into three principal types of work . . .

1. **Bending lines around corners, such as in snatch-block applications.**
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3. **Small traveling block applications for reducing line loads during hoisting operations.**

And the Baash-Ross Universal Utility Block is unique in that, simply by changing inexpensive accessory units, this one block will handle any of these three types of jobs. What's more, its capacity is 39 tons with 2 to 1 safety factor!

For example . . .

FLOOR BLOCK: Simply attach a base plate and you have a Floor Block that can be used with portable pulling outfits in well servicing work. Positive stops allow the Block to tilt 45° in any direction and a roller bearing swivel allows it to follow the line freely as it spools on and off the drum. To save time, in moving the Block from rig to rig, you can anchor an inexpensive base plate on each rig floor and quickly mount the Utility Block by inserting just one anchor bolt between plate and Block.

CORING BLOCK: When you need a small block in the crown for handling bailing and coring lines, simply attach a beam hanger unit to the Utility Block, fasten the beam hanger to a crown beam and you're ready to roll.

The hanger can be placed at any convenient point on the crown beam and when tightened, will not slip. The full-swiveling and tilting features permit the Utility Block to follow the line freely, minimizing wear on both line and sheave.

TUBING BLOCK: Fasten a tubing block clevis and your Utility Block is ready to serve as a Tubing Block in a wide range of well servicing applications. The clevis is free to swing from side to side and is also free to rotate . . . or can be locked against rotation by means of a built-in pin. The heavy-duty tapered roller bearing on the sheave gives the unit a high working capacity.

HEAVY DUTY *Performance Features*

Three-way adaptability is only part of the story on the Utility Block. Look at these top quality construction features . . .

- Side opening feature (by simply removing one bolt) saves time in placing lines around the sheave.
- Capacity 78,000 lbs.—with 2 to 1 safety factor.
- Sheave is alloy steel, 18" dia.—with flame-hardened groove 14½" dia.
- Bearings in both sheave and swivel are heavy-duty tapered roller type.
- Full 360° swiveling in all applications—or swivel may be locked by built-in pin.
- High pressure grease ducts direct to sheave and swivel bearings.
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From Equations 6 and 10:

$$(R_o)_1 = \frac{(R_w)_1 R_t F}{(R_w)_1 - \frac{N}{N - R_t}[(R_w)_1 - R_t]}$$

while $(R_o)_2 = F\,(R_w)_2$ or $F = (R_o)_2/(R_w)_2$.

Substituting the expression for F in the equation for $(R_o)_1$ and solving for R_t gives:

$$R_t = \frac{[(R_w)_1 + N]\,(R_o)_1\,(R_w)_2}{(R_w)_1\,(R_o)_2} - N \quad (14)$$

with $(R_w)_2 << N$

The above relation gives us a means of computing the bulk resistivity of the conductive solids in sandstone samples.

Table 1 shows examples of values of R_t computed with the use of Equation 14.

For the Saugus sandstone and the Modelo shaly sandstone condition Equation 13 is not properly fulfilled and the computed values of R_t may be in error by 10-20 per cent.

It is clear from the values of R_t shown in Table 1 that R_t does not vary much between different formations. This was to be expected as the bulk resistivity of conductive solids, mostly consisting of clay particles will be practically independent of the environment in which the particles are encountered.

Not including the Saugus sandstone and the Modelo shaly sandstone, we find as average value $R_t = 13.9\ \Omega$ cm. It we include the latter two samples we find $R_t = 13.15\ \Omega$ cm. as average value.

Resistivity of Oil and Gas Sands

Before the idea of current conduction by part of the solids in porous rocks was introduced, the relation between rock resistivity and hydrocarbon content was generally given by an empirical formula of the type:

$$S_w = (R_o/R)^n$$

$$\text{or } R = R_o\,(S_w)^{-n}$$

$$\text{and } 1/R = (S_w)^n/R_o$$

This relation was first given general significance by the work of Archie,[1] who found experimentally $n \sim 2$.

Since Archie's work, several other investigators carried out extensive experiments using many types of rocks and found that the value of n will vary considerably for different types of sandstones.

Guyod[5] quotes values found experimentally by Dakhnov to show:

$$1.7 \leqq n \leqq 4.3$$

Bailey and others[6] found $1 \leqq n \leqq 2.5$.

All these experiments were made on standstones of which the content

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OPERATING COST DATA

	Lease A Free Pumps	Lease B Rod Pumps
Number of wells	16	6
Period covered	6 mos.	6 mos.
Average B/W/M	1760 bbls.	955 bbls.
Cost/W/M	$78.00	$111.00
Total Cost/B	4.5¢	11.6¢

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of conductive solids was unknown and completely neglected. It is obvious that if the effect of conductive solids is neglected and Archie's formula applied as such, the apparent values of n will not only vary from rock to rock but also will depend upon the water salinity.

Computations from our experimental data indicate, however, that Archie's formula does apply, with n equal to, or nearly equal to 2.0 in cases where the influence of conductive solids is negligible or small, because of the high salinity of the interstitial water.

Table 2 shows examples of these data.

The deviations from the value of $n = 2.0$ may be partly due to combined experimental errors and the influence of conductive solids. Even if these would be eliminated, it would not be likely that n would have a completely constant value, but the variations in n will in general be small. Considering the enormous differences among the types of sandstones used in obtaining the data of Table 2, and the relatively small variations in n, it is believed that most of the anomalous values of n found by the aforementioned authors are due to neglecting the influence of the conductive solids.

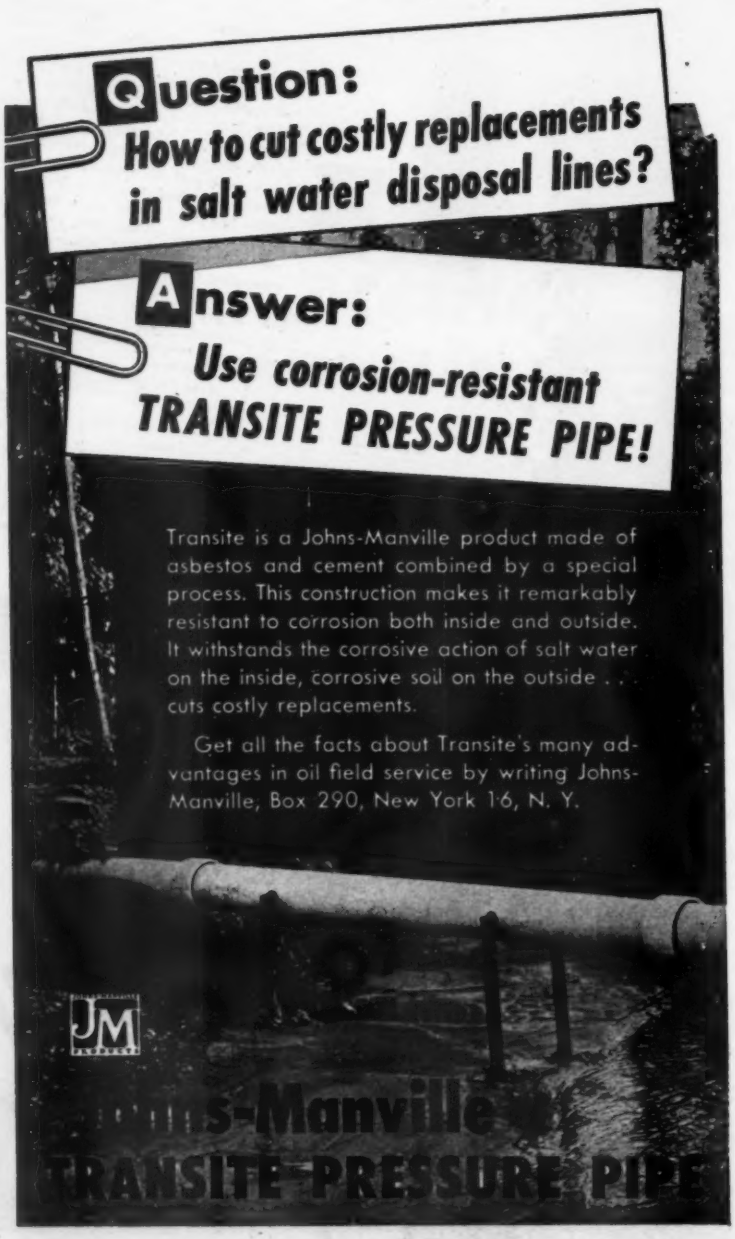
TABLE 1—RESISTIVITY CALCULATIONS, EQUATION 14

Sample description—	N	$(R_w)_1$	$(R_w)_2$	$(R_o)_1$	$(R_o)_2$	R_t
Pico sandstone (P-7)	543.6	971	20.5	5,615	318.3	20.5
Pico sandstone (P-5)	443	1,184	11.76	4,540	161.5	11.2
Berea sandstone (O-11)	1,554	1,131	10.6	11,310	182	9.8
Modello sandstone (M-9)	155	1,064	10.62	3,398	244.5	14.1
Saugus sandstone (S-3h)	77.6	342.7	12.3	3,230	549	11.6
Modelo shaly sandstone (M-4)	89.3	1,024	11.9	2,876	367.7	11.9

Note—Resistivities in Ω cm

TABLE 2—VALUES OF "n" (ARCHIE'S FORMULA)

Sample—	P%	K m darcies	S_w	R_w Ω cm.	R_o Ω cm.	R Ω cm.	n
Berea sandstone (O-7)	27.3	22.0	0.19	40.7	568	14,860	1.96
Berea sandstone (O-8)	28.9	40.2	0.188	30.3	404	1,170	2.0
Pico sandstone (P-4a)	33.3	3.18	0.295	36.1	386	4,550	2.02
Pico sandstone (P-4b)	28.4	3.90	0.21	35.9	271	7,610	2.14
Saugus sandstone (S-3b)	10.6	2.67	0.675	38.2	1,548	3,478	2.06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The deviations from the value of $n = 2.0$ may be partly due to combined experimental errors and the influence of conductive solids. Even if these would be eliminated, it would not be likely that n would have a completely constant value, but the variations in n will in general be small. Considering the enormous differences among the types of sandstones used in obtaining the data of Table 2, and the relatively small variations in n, it is believed that most of the anomalous values of n found by the aforementioned authors are due to neglecting the influence of the conductive solids.

To take the effect of conductive solids into account we must go back to the expressions for R in terms of F, R_w and the amount and resistivity of the conductive solids.

It is in trying to expand these formulas to include the presence of hydrocarbons that the differences between the equations of Patnode and Wyllie and those resulting from the assumption of a homogeneous mixture of the conductive media become evident.

If one assumes an independent conduction through the conductive solids as suggested by the formula:

$$\frac{1}{R_o} = \frac{1}{\rho_t} + \frac{1}{FR_w}$$

the presence of oil would not have any effect on that part of the total conductivity represented by $1/\rho_t$.

It is obvious that the conduction through the water is influenced by the presence of oil in the same way as in the case where none of the solids is conductive. This means that the term $1/FR_w$ is replaced by $(S_w)^n/FR_w$.

Again combining the two conductivities for the parallel paths we obtain:

$$1/R = 1/\rho_t + (S_w)^n/FR_w \quad (16)$$

The outcome of experiments to test Equation 16 proved untenable the assumption of an independent conductive path through the solids.

The evidence to that effect will be illustrated by an example:

A sample of Berea sandstone was saturated with water of two different salinities successively and F and ρ_t were computed using Equation 3 after the resistivities were measured in both cases, and the following data were obtained:

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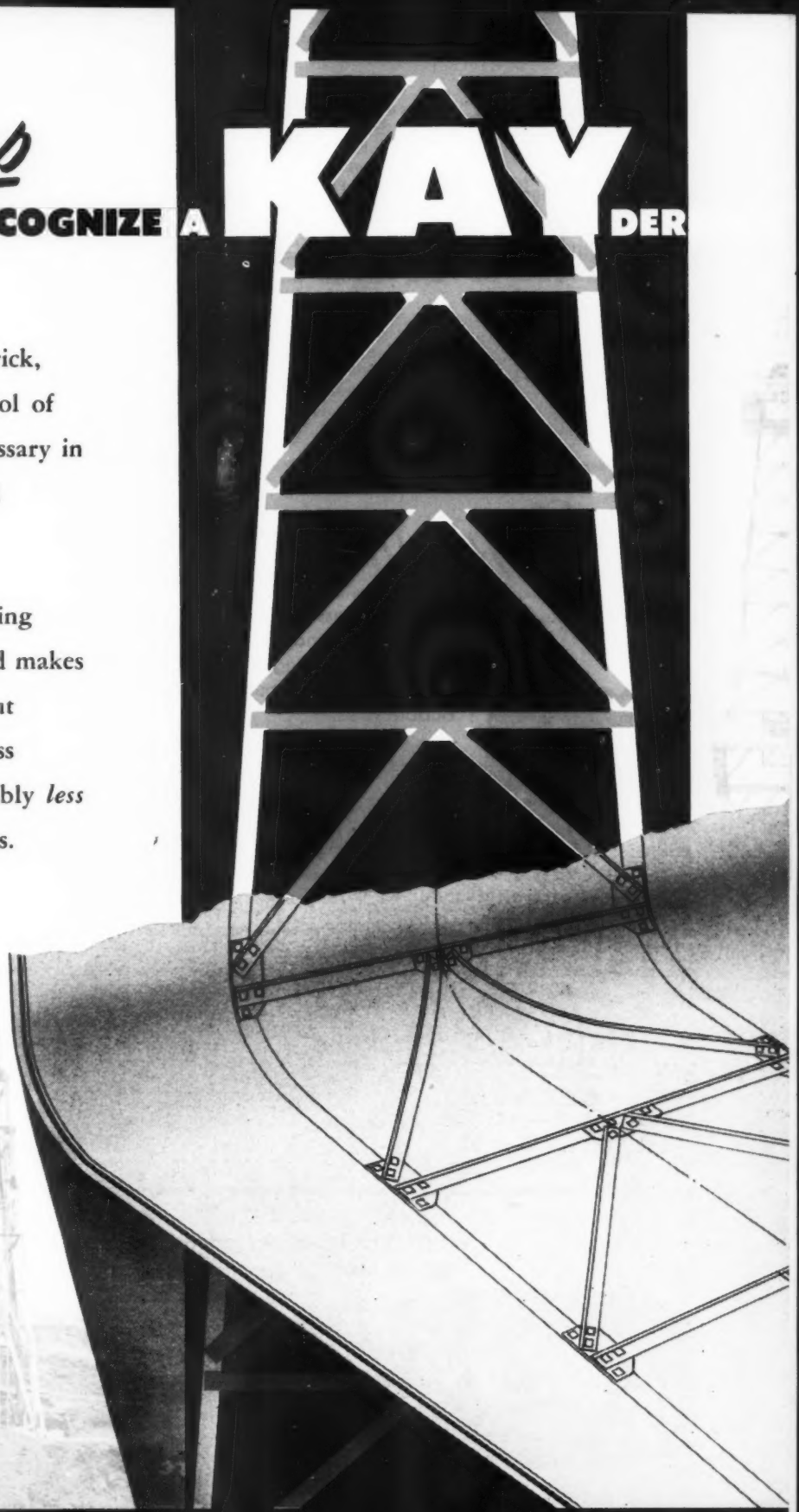

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$(R_w)_1 = 13.6\ \Omega$ cm.
$(R_w)_2 = 1{,}009\ \Omega$ cm.
$(R_o)_1 = 190\ \Omega$ cm.
$(R_o)_2 = 8{,}500\ \Omega$ cm.

This leads to $F = 14.1$ and $1/\rho_t = 0.0000476$ or $\rho_t = 21{,}000\ \Omega$ cm.

The sample was then saturated with crude oil by the capillary pressure method until an oil saturation of 0.78 was obtained. This means $S_w = 0.22$.

Applying Equation 16 gives:

$$\frac{1}{82{,}800} = \frac{1}{25{,}000} + \frac{(0.22)^n}{14.1 \times 1{,}009}$$

which makes n imaginary.

Physically the above means that assuming an independent continuous path through the conductive solids, the conductivity of the conductive solids as distributed would be larger than the combined conductivity of the entire system, which of course is not possible. Obvious objections to the presentation of the current conduction by two parallel paths, one through the interstitial water and one through the conductive solids, are that the two conducting media are not everywhere continuous and at many places interconnected, so that an equivalent circuit of two parallel resistances is not at all adequate.

These reasons force us to abandon the concept of a network of conductive solids with an independent resistivity of the conductive solids as distributed.

Using the alternative hypothesis, that is regarding the system of randomly distributed conductive solids and interstitial water as a slurry of conductive particles in an electrolyte, the following analysis can be made:

For a 100 per cent water-saturated sand we may write:

$$\frac{1}{R_o} = \frac{1}{F}\left[\frac{X_t}{R_t} + \frac{(X_w)_1}{R_w} + \frac{(X_w)_2}{R_w}\right] \quad (17)$$

where $(X_w)_1$ and $(X_w)_2$ are arbitrary fractions of the water phase satisfying the condition $(X_w)_1 + (X_w)_2 = X_w$, if X_w denotes the fraction of the conductive mixture consisting of water.

If X_t/R_t is negligible, this becomes:

$$\frac{1}{R_o} = \frac{1}{F}\left[\frac{(X_w)_1}{R_w} + \frac{(X_w)_2}{R_w}\right]$$

If we now replace the fraction $(X_w)_2$ by oil with $R_{oil} = \infty$ we would have:

$$\frac{1}{R} = \frac{1}{F}\left[\frac{(X_w)_1}{R_w} + 0\right]$$

However, the oil does not replace the water randomly but has a specific distribution in the center of the pores. This changes the effect of the inert framework on the remaining conductive medium so that we must replace F by F'.

The resistivity of the partly oil-saturated rock then may be expressed by:

$$\frac{1}{R} = \frac{1}{F'}\,\frac{(X_w)_1}{R_w}$$

As $(X_w)_1$ is the fraction of the pore space occupied by water we have $(X_w)_1 \equiv S_w$, where S_w denotes the fractional water saturation.

In the preceding paragraphs we have shown that if the effect of conductive solids may be neglected, Archie's formula may be applied with good accuracy. This gives:

$$\frac{1}{R} = \frac{(X_w)_1}{R_w}\,\frac{1}{F'} = \frac{S_w^2}{FR_w}$$

so that

$$\frac{F'}{F} = \frac{(X_w)_1}{S_w^2} = \frac{1}{S_w}$$

and

$$\frac{1}{F'} = \frac{S_w}{F}$$

This indicates that the change in the formation factor or cell constant of the inert framework is inversely proportional to the fraction of the conductive medium that has not been replaced by the oil.

Applying this argument to the case where X_t/R_t is not negligible we obtain:

$$\frac{1}{R} = \frac{1}{F'}\left[\frac{X_t}{R_t} + \frac{(X_w)_1}{R_w}\right] \quad (18)$$

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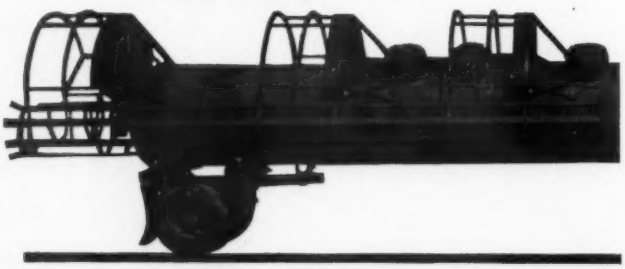

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where $1/F' = X_c/F$ if X_c denotes the fraction of the conductive medium not replaced by oil.

In terms of porosity, water saturation, and amount of conductive solids per unit bulk volume we have:

$$X_c = \frac{PS_w + P_t}{P + P_t} \text{ and as } \frac{P_t}{P} = \frac{R_t}{N}$$

$$X_c = \frac{S_w + (R_t/N)}{1 + (R_t/N)} = \frac{NS_w + R_t}{N + R_t}$$

As noted before:

$$X_t = \frac{P_t}{P + P_t} = \frac{R_t}{N + R_t}$$

and finally:

$$(X_w)_1 = \frac{PS_w}{P + P_t} = \frac{NS_w}{N + R_t}$$

Substitution of the above expression in Equation 18 gives:

$$\frac{1}{R} = \frac{NS_w + R_t}{(N + R_t)\,F} \times \left[\frac{1}{N R_t} + \frac{NS_w}{(N + R_t)\,R_w} \right] \quad (19)$$

For the 100 per cent water-saturated sand we have:

$$\frac{1}{R_o} = \left(\frac{X_t}{R_t} + \frac{X_w}{R_w} \right) \frac{1}{F} = \left[\frac{1}{N + R_t} + \frac{N}{(N + R_t)\,R_w} \right] \frac{1}{F} = \frac{R_w + N}{R_w\,(N + R_t)} \frac{1}{F}$$

$$\text{so that } \frac{1}{F} = \frac{R_w\,(N + R_t)}{R_o\,(N + R_w)}$$

Substitution of this expression for $1/F$ in the equation for $1/R$ gives:

$$\frac{1}{R} = \frac{(NS_w + R_t)\,R_w}{R_o\,(R_w + N)} \left[\frac{R_w + NS_w}{(N + R_t)\,R_w} \right]$$

This may be reworked to:

$$\frac{R_o}{R} = \frac{(NS_w + R_t)\;(NS_w + R_w)}{(N + R_t)\quad(N + R_w)}$$

Solving for S_w gives the equation

$$S_w^2 + \frac{R_t + R_w}{N} S_w + \frac{R_t R_w R - (N + R_t)\,(N + R_w)\,R_o}{RN^2} = 0 \quad (20$$

Equation 20 takes the place o Archie's formula for all cases where the influence of conductive solids or the resistivity may not be neglected

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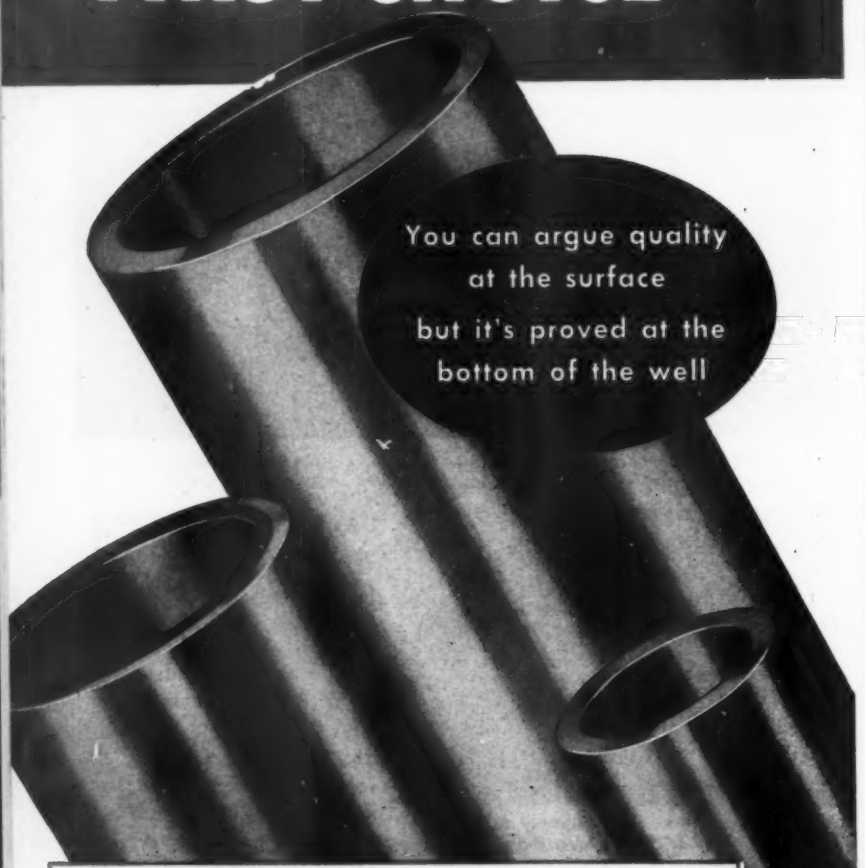

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If the amount of conductive solids goes to zero, N approaches infinity and Equation 20 reduces to:

$$S_w^2 = R_o/R$$

Using Equation 20, values of S_w were computed for several cases where the water saturation was known from volumetric measurements. The following examples serve to illustrate the general applicability of the formula:

1. **Berea sandstone:**
   $R = 82{,}000\ \Omega$ cm.
   $R_w = 1{,}009\ \Omega$ cm.
   $N = 1{,}490$
   $R_o = 8{,}500\ \Omega$ cm.
   $R_t = 19.5\ \Omega$ cm.

   Equation 20 gives: $S_w = 0.189$
   Volumetrically measured: $S_w = 0.22$

2. **Modelo sandstone:**
   $R_w = 7{,}600\ \Omega$ cm.
   $R = 805\ \Omega$ cm.
   $N = 155$
   $R_o = 4{,}615\ \Omega$ cm.
   $R_t = 14.1\ \Omega$ cm.

The values of R_t and N were obtained from measurements on a different sample from the same large specimen. This may have introduced some slight errors.

Equation 20 gives: $S_w = 0.522$
Volumetrically measured: $S_w = 0.472$

3. **Modelo sandstone:**
   $R = 3{,}504\ \Omega$ cm.
   $R_w = 1{,}024\ \Omega$ cm.
   $N = 89.3$
   $R_o = 2{,}876\ \Omega$ cm.
   $R_t = 11.9\ \Omega$ cm.

From Equation 20: $S_w = 0.805$
Volumetrically measured: $S_w = 0.792$

In practice, the value of R_t is often not known and an approximate value must be assumed.

To determine the influence of errors in R_t on the computed values of S_w, the water saturation was calculated for the case of the Berea sandstone for two other arbitrarily assumed and widely deviating values of R_t.

The results are shown in Table 3.

TABLE 3—VALUES OF S_w (WATER SATURATION)

R_t measured	R_t assumed	S_w computed	S_w measured
19.5	19.5	0.189	0.22
...	5.0	0.195	0.22
...	40.0	0.179	0.22

We see that large variations in the values of R_t have little influence on the computed values of S_w. Therefore it will be satisfactory in most cases to use the average value found in the preceding paragraphs, namely $R_t = 13.5\ \Omega$ cm., if more accurate data are lacking.

Application of Resistivity Relations

The resistivity logs give us in general for each formation only two quantities, namely the true resistivity of the formation and the true resistivity of its invaded zone.

In some cases, however, the upper part of the formation may be saturated with oil or gas and the lower part with water.

Where we have such a combination of an oil zone and a water zone in the same reservoir rock, the resistivity log furnishes us four quantities; namely, the true resistivities of the oil horizon and of the water horizon, and the invaded zone resistivities for both horizons.

Fig. 1 gives a somewhat idealized example of the electrolog curves for such combinations.

From the resistivity of the infiltrated zone and the true resistivity of the water horizon, and measuring the self-potential kick for the formation in question we can compute the quantities N and R_w as outlined in a paper on the characteristics of the electrochemical potentials in drill holes by this author.[7] After the computation of these quantities, we can determine whether or not the condition (13) $R_w << N$ is fulfilled. If this condition holds true, we can apply Archie's formula using the true resistivities of the water and the oil horizon. Denoting the latter respectively by $(R_t)_1$ and $(R_t)_2$ we then find the oil saturation of the oil zone as:

$$S_o = 1 - S_w = 1 - [(R_t)_1/(R_t)_2]^{1/2} \quad (21)$$

If condition (13) does not hold true, Equation 20 may be applied with $R_o = (R_t)_1$; $R = (R_t)_2$ and $R_f = 13.5\ \Omega$ cm.

Instead of using the estimated value of 13.5 Ω cm. for R_f it would be impossible to calculate R_f by making use of the relation between the water saturation of the oil horizon and the water saturation of its invaded zone.

This relation was first established by Tixier, which is discussed in detail in a previous paper by this author.[7] The relation is of the form:

$$(S_w)_i^n = S_w \text{ with } n \sim 2 \quad (22)$$

where $(S_w)_i$ and S_w are respectively the water saturations of the invaded zone and of the undisturbed formation.

Applying Equation 20 to the invaded zones of the water and oil horizon whose resistivities are respectively $(R_t)_1$ and $(R_t)_2$, with $R_o = (R_t)_1$, and $R = (R_t)_2$, we find $(S_w)_i$ as a function of R_f. Similarly using the true resistivities of the undisturbed parts of the two zones in Equation 20 gives S_w as a function of R_f. Substituting $(S_w)_i^2$ for S_w in the latter relation gives us two equations with two unknowns namely $(S_w)_i$ and R_f, from which we can find both quantities.

It is doubtful, however, whether solution of R_f by the above procedure is at all worth while. As was shown before, appreciable errors in assumed values of R_f affect the value of S_w as calculated from Equation 20 only slightly.

The errors introduced by estimating the value of R_f are probably smaller than those due to the uncertainty of the value of n in relation (22), if that relation is used to find R_f and S_w.

In most cases, however, no distinct separation exists between a water and an oil horizon in the same rock unit, and it is not known whether the rock contains any hydrocarbons or not.

We then have essentially three relations, of which the first two are obtained from Equation 19 and may be written as:

$$\frac{1}{R_t} = \frac{[N(S_w)^{1/2} + R_f]\,[N(S_w)^{1/2} + R_{mf}]}{FR_{mf}\,(N + R_f)^2} \quad (23)$$

and

$$\frac{1}{R_t} = \frac{(NS_w + R_f)\,(NS_w + R_w)}{FR_w\,(N + R_f)^2} \quad (24)$$

with R_{mf} denoting the mud filtrate resistivity and R_w the resistivity of the connate water.

The third relation is obtained by measuring the S.P. kick and is of the form:

$$\text{S.P.} = f(N) \log R_{mf}/R_w \quad (25)$$

On the other hand there are four unknowns, even if we use an estimated value of R_f and Tixier's rela-

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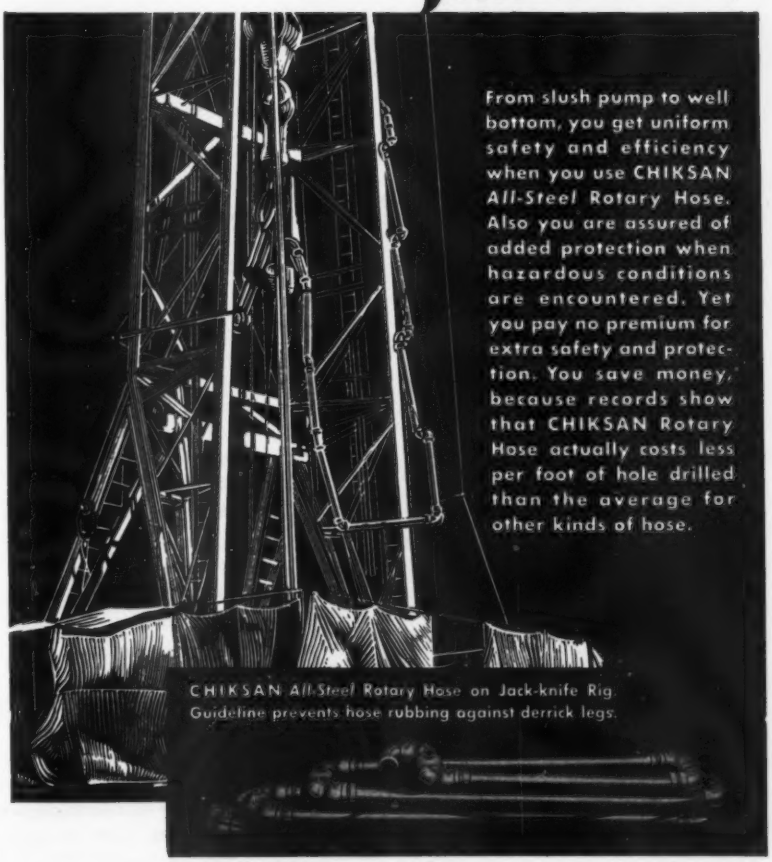

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tion between S_w and $(S_w)_i$ as was done in formulating Equation 23.

The unknown quantities are S_w, N, F, and R_w. This means that if no further information were available there is no unique solution for the fluid content of a single formation under consideration. Actually putting $S_w = 1$ we can solve the above relations for F or assuming a certain value of F we can find a corresponding S_w. This shows that it is impossible in an isolated case to distinguish between a water sand with a high formation factor and an oil sand with a lower value of F.

Fortunately it is possible in many cases to distinguish porous water sands qualitatively on an electrolog. Such sands will usually have a much higher infiltrated zone resistivity than true resistivity in contrast to dense and oil-bearing formations where these values are much closer together.

As was shown elsewhere,[7] for such water sands we can compute the values of R_w and of N.

For all the other formations we must find R_w by interpolation between the connate water resistivities of adjacent porous water sands.

If core samples are available, either F or the electrochemical formation constant can be determined in the laboratory.

If we assume that R_s has been determined by interpolation between values obtained from porous water sands in the absence of information from core samples, we easily find N using relation (25).

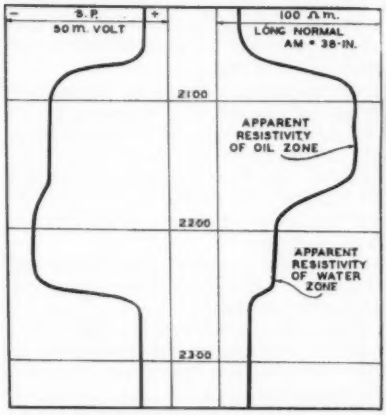

Fig. 1—Electric log of oil and water zones in same reservoir rock.

With N and R_w known, Equations 23 and 24 may be combined to solve for S_w. This is most easily done graphically by plotting F as a function of S_w for both relations and finding the real values of S_w and F as the coordinates of the intersection point of the two graphs.

If condition (13): $R_w << N$ is fulfilled, Equation 24 may be reduced to:

$$1/R_t = S_w^2/FR_w$$

$$\text{or } F = R_tS_w^2/R_w \qquad (26)$$

Combination of this expression with Equation 23 still gives a biquadratic equation in $(S_w)^{1/2}$ and the graphical solution remains the easiest.

F is of importance for the determination of porosity which can be done using the empirical formula: $F = P^{-1.8}$.

Knowing the porosity and the oil saturation $S_o = 1 - S_w$ we can calculate the total amount of oil present per acre-foot of the oil horizon.

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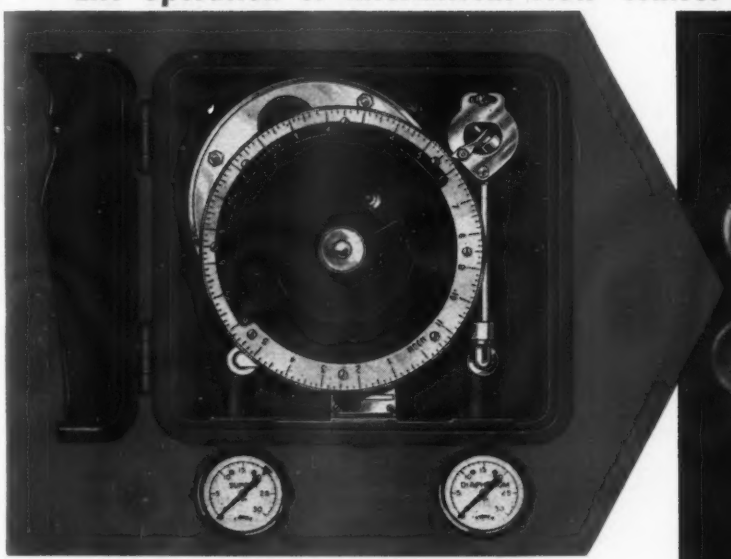

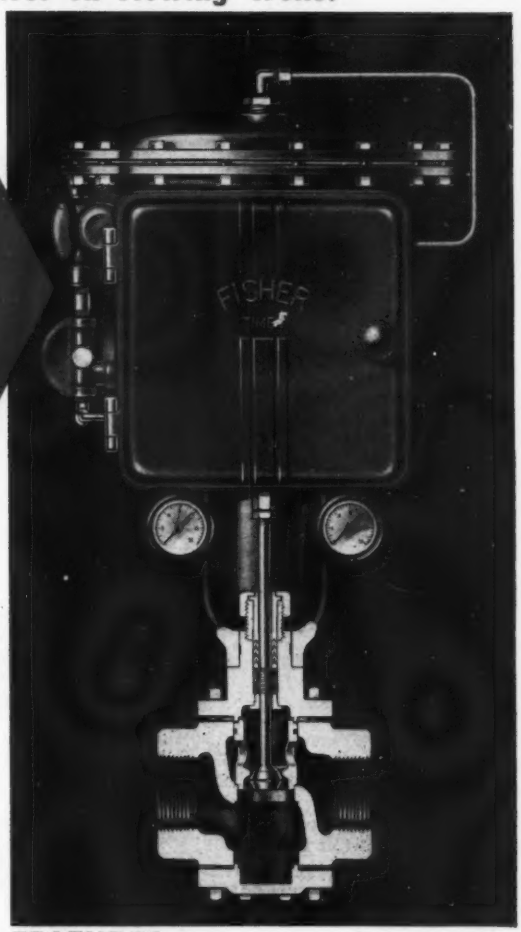

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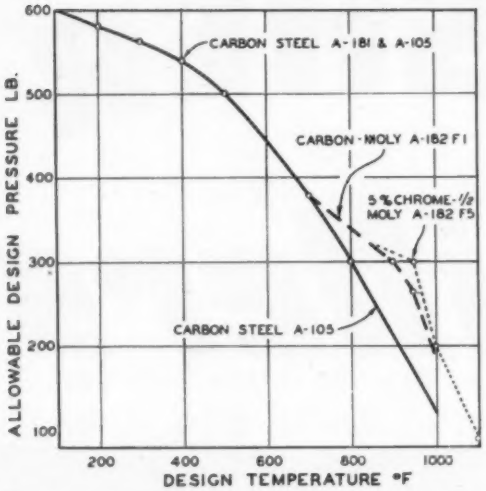

Fig. 1—Maximum nonshock-service pressure ratings at temperatures from 100° to 1,100° F., for 300-psi. A.S.A. flange.

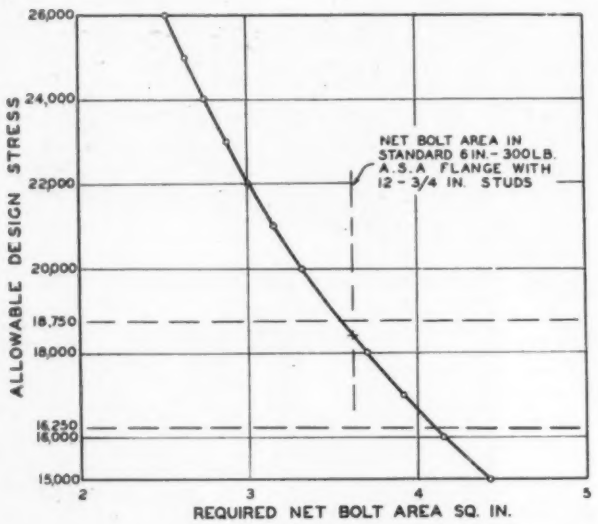

Fig. 2—(Left) Required net bolt area with different stud materials (based upon 6-in. 300-psi. A.S.A. flange with sheet gasket).

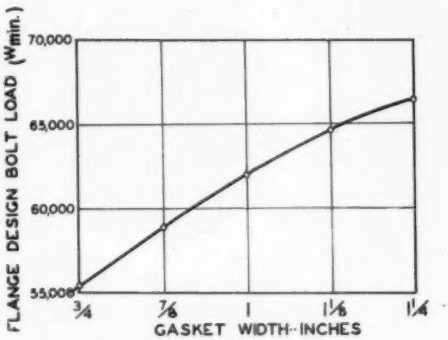

Fig. 3—(Above) Flange design bolt load with varying gasket width (based upon 6-in. 300-psi. flange using sheet gasket. Assumed yield of 4,500, gasket factor of 2.5; design conditions, 600 psi. at 100° F.).

by O. L. Lewis*

THERE are two primary factors involved in the choice of a flange material. One is allowable stress under working conditions, and the other is corrosion resistance.

The most commonly used carbon-steel forged flange material is A.S.T.M. A-181, which is limited to flanges of 150 and 300-lb. primary service ratings by A.S.A. Code B16e. This material is stocked by all major flange manufacturers and is available in both Grade I, with a 60,000-psi. minimum tensile, 30,000-psi. minimum yield, and 15,000-psi. allowable design stress, and in Grade II with 70,000 psi. minimum tensile, 36,000 psi. minimum yield, and 17,500 psi. allowable design stress.

Open-hearth or electric furnace steel is specified for both grades. The primary difference in the two is in chemical composition necessary to produce additional strength in the Grade II material. Both grades are limited to 0.35 per cent carbon for ease of welding so silicon up to 0.30 per cent is usually added to the Grade II material to obtain necessary physical properties.

An indication of the difference in performance to be expected is the fact that Grade II material is specified to have only about 81 per cent of the allowable elongation and about 68.5 per cent of the reduction in area allowed in the Grade I material. A-181 is also limited to maximum design temperatures of 750° F. by its tendency to graphitize. As higher temperatures are approached, material selection must take into account creep strength, resistance to graphitization, and oxidation.

In refinery service A.S.T.M. A-105 material is normally specified for 150 and 300-lb. class flanges when design temperature is from about 750° to 950° F., and most manufacturers stock all 600-lb. and higher class flanges in this material. It is also available in both Grade I and Grade II each carrying the same minimum tensile and yield requirements as A-181 material. The elongation and reduction in area requirements are both higher than A-181. The chemical composition is approximately the same. The primary difference in the two materials is that A-105 is heat treated for grain refinement.

As even higher temperatures are encountered it is necessary to give additional consideration to creep strength and graphitization. A-182 GRADE FI, a carbon-molybdenum steel, seems to be the answer to both

*Consulting engineer, Tulsa.

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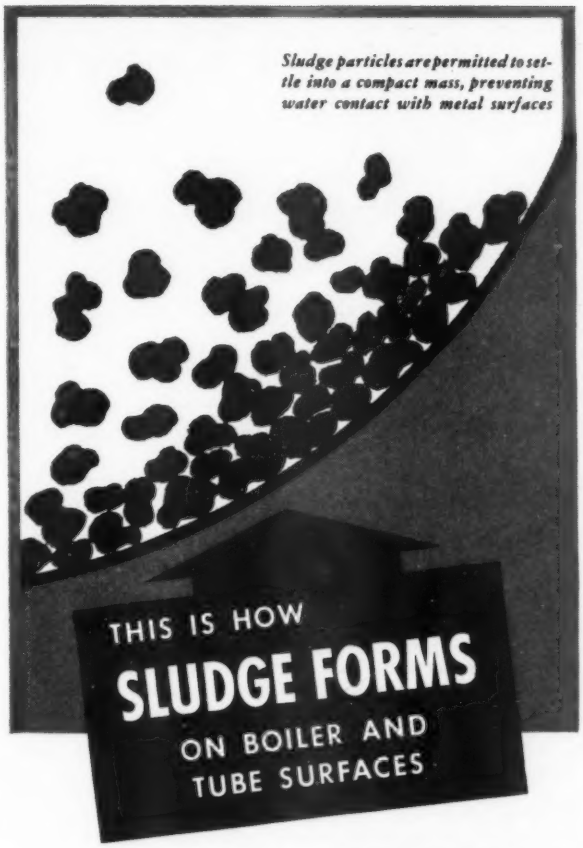
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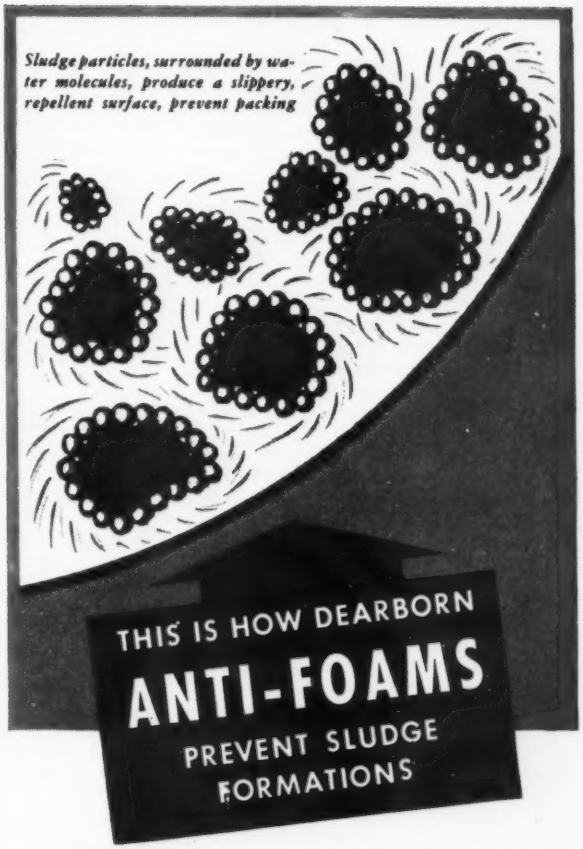
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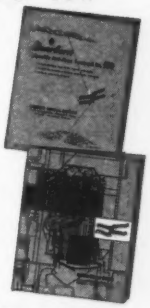

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of these considerations up to about 1,000° F. It carries a minimum tensile requirement of 70,000 psi., minimum yield of 40,000 psi., and allowable design stress of 17,500 psi. from minus 20° F. to 650° F. which is the same as the Grade II carbon-steel materials.

When temperatures above 1,000° F. are encountered, A.S.T.M. A-182 Grade F5, 5 per cent chromium, ½ per cent molybdenum should probably be used. This is a more common piping material for intermediate corrosion allowance in this temperature range and has good resistance to oxidation as well as a high creep stress.

The 2 per cent chrome ½ per cent moly Grade F3 or 2¼ per cent chrome 1 per cent moly Grade F7 would both probably be satisfactory over the same temperature range but wide acceptance of the 5 per cent chrome ½ per cent moly F5 material has led to it being more generally available at little if any increase in price over the lower alloys suitable for the same applications within the range.

When excessive corrosion or extreme temperatures in the range of 1,200° to 1,500° F. are encountered the A.S.T.M. A-182 Grade F8 should be considered as it is also a widely accepted material for severe service conditions. It may be obtained with added columbium, titanium, or molybdenum if corrosion resistance, low temperature toughness, or creep strength greater than provided by the basic material are required.

It is quite often possible to discount the effect of corrosive fluids on the flanges by using either a Van Stone type joint or a slip-on flange welded with alloy material and faced for a gasket surface. By adopting one of these designs the flange material can be specified strictly on the basis of required mechanical strength with a resultant saving in over-all cost.

Fig. 1 is based on a 300-lb. A.S.A. flange other than the ring-joint type. It will be noted (Fig. 1) that the carbon steel, carbon-moly, and chrome-moly curves are the same from 100° to 700° F. In that range there is no advantage in allowable stress due to alloy materials. The only advantage in alloy material in this temperature range is in increased corrosion resistance. At 700° F. both the carbon-moly and chrome-moly materials start exhibiting an advantage in allowable stress over the carbon-steel material. The carbon-moly material, due to higher creep resistance, retains a significant advantage over carbon steel up to its maximum rated temperature of 1,000° F.

From 900° up to 1,100° F. 5 per cent chrome ½ per cent moly has slightly higher creep resistance than the carbon-moly and is much more resistant to oxidation and scaling.

The 18 per cent chrome 8 per cent Ni. Grade F8 material was not plotted as A.S.A. has not yet released definite ratings on flanges of this material. Allowable working pressures for this and other materials not specifically covered by A.S.A. may be arrived at by using for allowable stress, 25 per cent of the minimum tensile in lower temperature ranges or 100 per cent of the stress required to produce a creep rate of 0.01 per cent per 1,000 hours in the higher temperature ranges and following A.S.M.E. rules for bolted flanged connections as a basis for design.

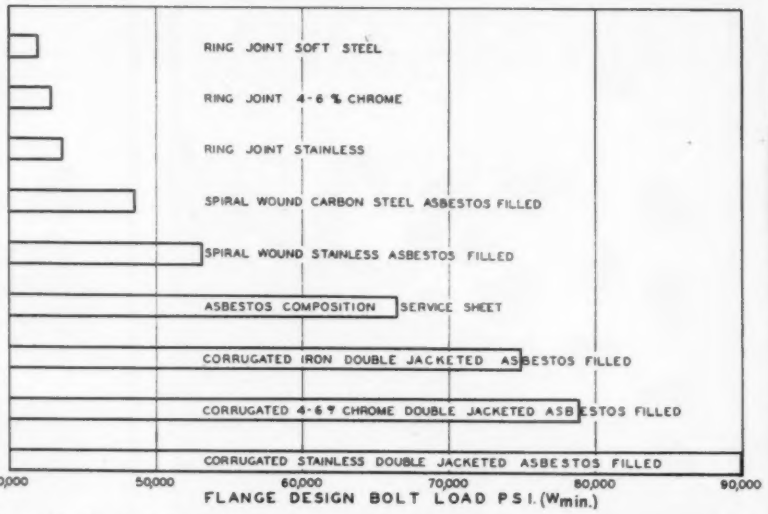

Fig. 4—Design bolt loads for common gasket materials (based on 6-in. 300-psi. A.S.A. flange, at 600 psi. and 100° F.).

Bolt Stud Materials

Flange bolting is probably the most neglected item in piping design procedure as far as material specification is concerned. Actually many joint failures which have been blamed upon flanges and gaskets are rightfully due to insufficient bolting and its installation. The boiler-construction code recognizes these factors and includes a design factor specifically to provide additional safety against abuse. This margin of safety is 50 per cent of the excess above the required minimum bolt load. Since margin against such abuse is primarily required during initial bolting up, the flange design is not materially altered. Reasonable care must be taken in tightening bolts as overpulling definitely decreases the margin of safety against leakage.

The allowable design stress values for bolts are based upon 20 per cent of minimum tensile strength or 25 per cent of the yield strength for 0.2 per cent offset, whichever is lower. Actually flange bolting is nearly always working at stresses above the design value. Recognizing that this will probably be true, particularly of a joint operating near the maximum allowable pressure, it is worth while to consider the limitations of these materials and their effect upon joint design.

In refinery practice, heat-treated carbon-steel bolting equal to A.S.T.M. A-261 for low-pressure, low-temperature services only is normally used. This bolting is usually restricted to 150-lb. rating flanges below 450° F. Above these limits practically all design is based upon alloy bolting of applicable grade under A.S.T.M. A-193. Regardless of quality or heat treatment of carbon-steel studs, the maximum allowable design stress is 25 per cent of 55,000 multiplied by a factor of 0.92.

There are applications for the lower alloy bolts but in general refinery practice it is common to go from the carbon-steel class to the A-193 Grade B7 chrome-moly. This material is equivalent to S.A.E. 4140 and "chrome triplex."

When elevated temperatures are encountered where creep strength becomes the design basis the most common material is the A-193 Grade B14 chrome-moly-vanadium.

Special design conditions may make it advantageous to specify one of the intermediate grades but in general, availability will be better and the price will be found comparable if one of the more standardized grades is specified.

All of the alloy stud materials may be finished with varying heat treatment to provide different physical properties. The commonly stocked material gives a tensile of 125,000 psi. and a minimum yield of 105,000 psi. Tensile strength may vary from 160,000 psi. down to 90,000 psi., depending upon the particular heat treatment specified. The yield strength at the same time will vary from 160,000 to 80,000 psi. Where special joint design is involved it is possible at times to use a special heat treatment for studs in combination with adjusted gasketing, to increase the allowable working pressure of a standard flange.

Fig. 2 shows the relationship

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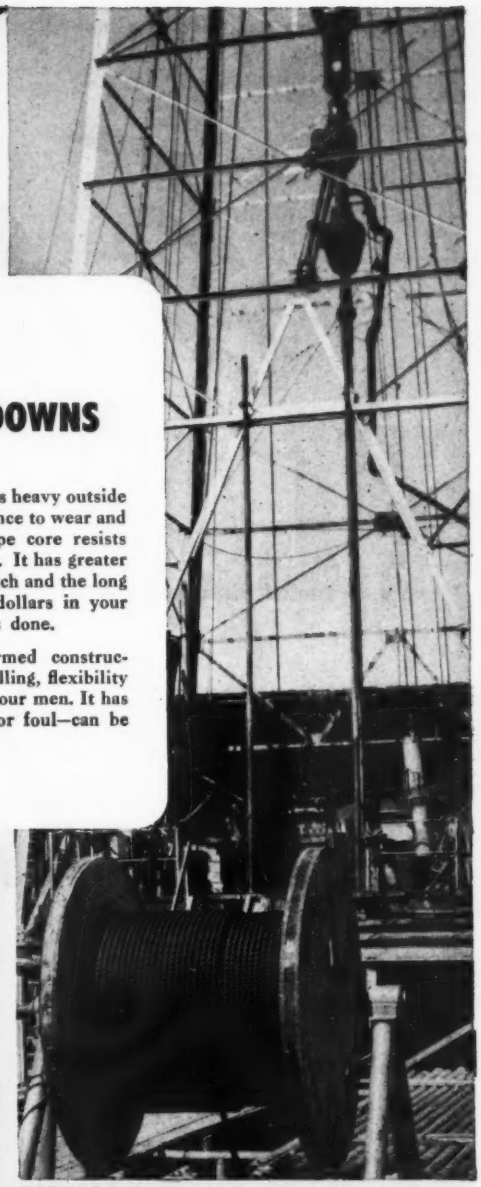

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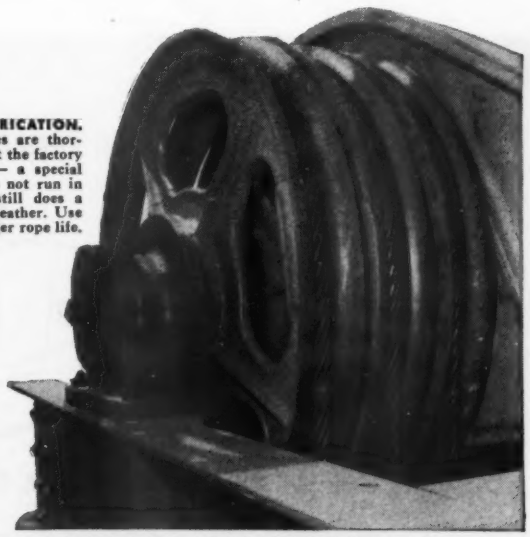

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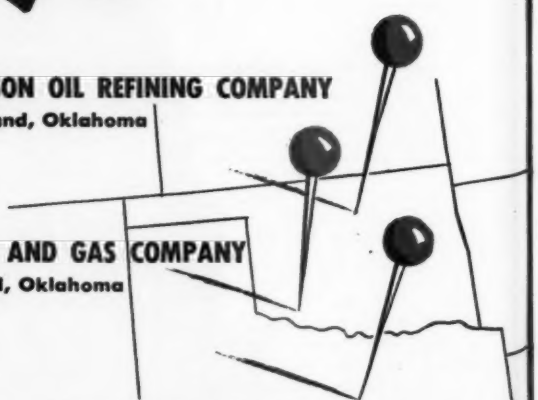

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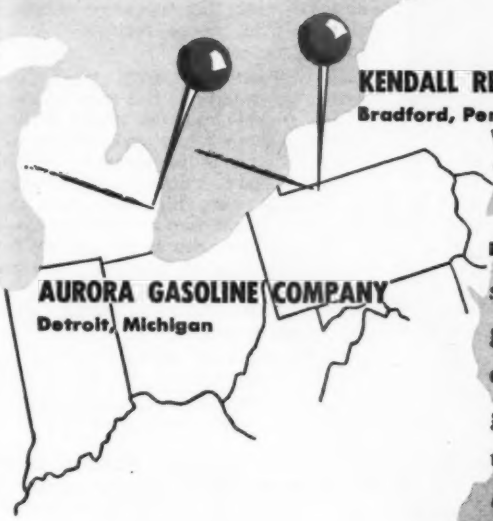

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between tensile strength and number of bolts theoretically required in a 6-in., 300-lb. flange at maximum working pressure (600 psi. at 100° F.). Calculations for this chart were based on a compressed asbestos, service sheet, ring gasket.

Naturally if bolting is used in the higher stress range, (above the 20,000 psi. allowable) the flange itself would have to be made of stronger material or have additional thickness in order to develop the full strength of the bolting.

Joint Gasketing Materials

The function of a gasket is to create and maintain a tight seal between two separable members of a joint assembly. Such a seal can be obtained by perfect machining of the mating surfaces but this procedure is expensive in any instance and impractical in general piping installations where the two mating flanges may be furnished by different manufacturers and both be subjet to a certain amount of weathering and slight damage in handling. All refinery-piping joints depend upon a suitable gasket material to make a tight seal.

Gaskets are relatively inexpensive and usually the most easily replaced element of the joint. A seal is effected by the yield or flow of the gasket material into imperfections of the flange contact faces. The total contact area must be sufficient to hold internal pressures and the gasket must be resilient enough to take up slight differences in facing alignment.

A gasket materal is chosen to fulfill four functions.

1. **Yield** sufficient to flow into and seal all imperfections and form a perfect contact with flange facing.
2. **Resist attack** from fluids or gases contained in piping system.
3. **Maintain** a satisfactory joint under operating temperature conditions.
4. **Compensate** for minor differences in flange angularity.

A great many gaskets are available depending upon flange design and facing. As practically all refinery work is based on either raised-face or ring-joint flanges, only common materials for those facings will be covered here.

All raised-face-flange types use what is called a flat-ring gasket. These gaskets may be made of any material from paper to solid metal. Some of the more common gasket materials are rubber, compressed asbestos, copper, aluminum, iron, and combinations of two or more of these materials. Thicknesses in gaskets for refinery use range from ⅛ to ¼ in. dependent upon material and types of joint. The most commonly used gasket types are:

1. **Smooth ring gasket**—having an i.d. equal to the i.d. of the flange and an o.d. equal to the diameter of the flange bolt circle less one bolt diameter.
2. **Metal jacketed asbestos filled combination gasket**—having a corrugated face. Usually the same size as the smooth sheet gasket.
3. **Asbestos-metal combination type** spirally wound which gives a serrated face.

Gasket width may be varied and within limits reduction in width improves joint tightness for a given load. The gasket must not be too narrow or too soft or it will be crushed beyond the point of usefulness by normal bolt load.

The ring-joint gasket is used almost exclusively in refinery work where either high temperatures or high pressures are encountered. It is considered the most efficient of the standard facings covered by A.S.A. B16e. The ring is wedged into grooves as the bolts are drawn up, producing the necessary gasket contact pressure with minimum bolt tension because of the reduced contact area. Dimensions of the ring-joint gasket are standardized by A.S.A. and the only variable usually encountered is in material. The rings are always of metal, usually soft iron or mild steel. Alloy materials came into use only when higher temperature or corrosion is involved.

The choice of gasket depends upon operating conditions and the applica-

(Continued on page 145)

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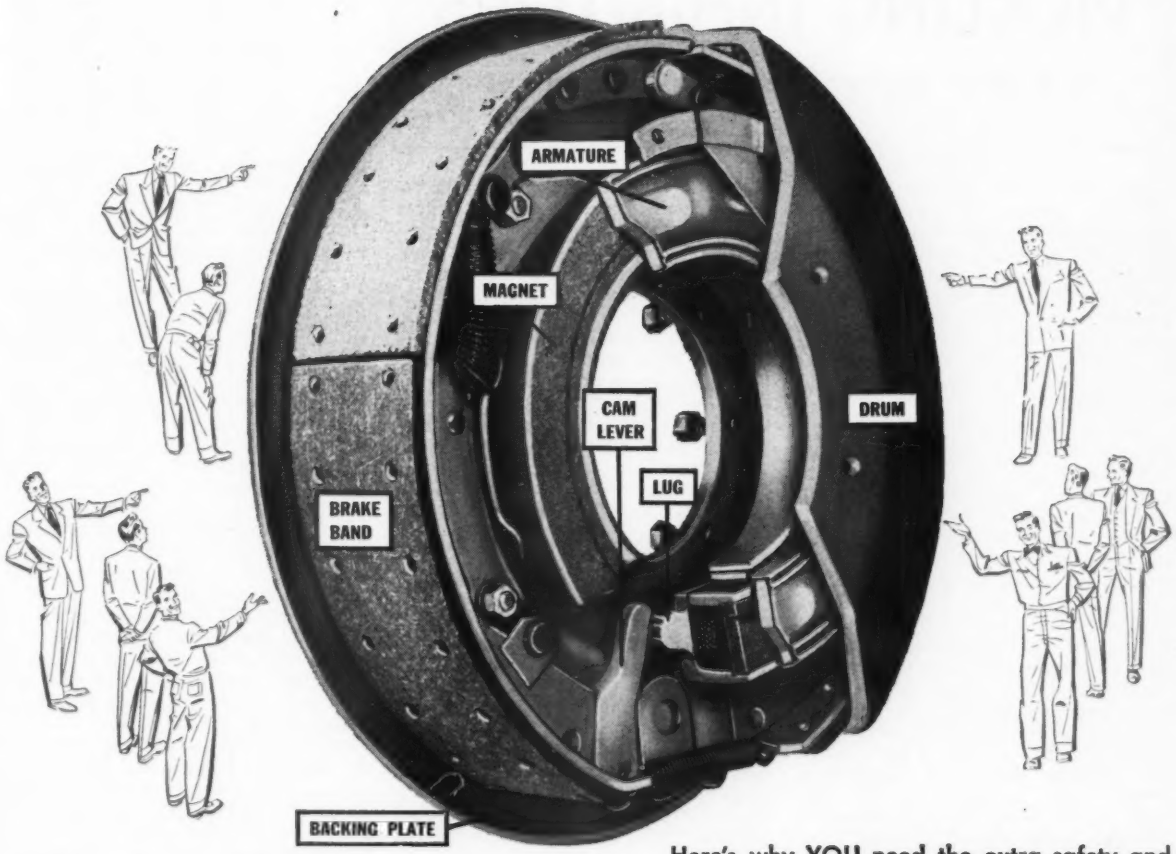

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WATER-SOLUBLE CUTTING OILS *as* PICKLING INHIBITORS

by Karl F. Hager* and Morris Rosenthal†

RECLAMATION of rusted equipment around oil refineries and other industrial plants is becoming of increasing national importance, especially since it has been shown that corrosion losses in this country are over 5 billion dollars annually. Furthermore, in the event of rapid mobilization of industry in emergencies, recovery of rusted equipment would be essential.

Normal procedure for derusting equipment that is to be rehabilitated is to treat the parts in an inhibited acid pickling bath. Sulfuric acid to which an inhibitor has been added is the commonest pickling acid employed mainly because of its low cost, availability, and lack of fuming hazard. The chief function of the inhibitor is to retard acid attack against the base metal without appreciably retarding acid attack against rust, thus reducing the economic losses of the base metal and pickling acid.

Investigations of acid pickling inhibitors at this laboratory have led to the findings that most commercial water-soluble cutting oils are efficient inhibitors against acid attack of the base metal and, in addition, give a temporary protection against rerusting to the freshly pickled, highly active, metal surface.

Thus the oil industry which manufactures these cutting oils can, in emergencies when commercial inhibitors are not at hand, employ these oils as inhibitors in acid pickling and for the additional temporary after-pickling surface protection. The sales departments of the cutting-oil-manufacturing companies can also stress to their metal-processing-industry clients that these cutting oils could also be employed as pickling inhibitors.

*Department of the Army, Office of the Chief of Ordnance, Research and Development Division, Suboffice Rocket, Fort Bliss, Tex. †General Electric Co., Fort Bliss, Tex.

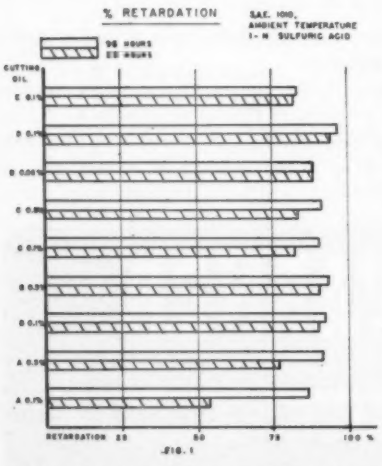

FIG. 1

Fig. 1—Effect of amount of cutting oil (as inhibitor), on corrosion retardation rate.

Experimental Procedure and Results

In order to determine the degree of retardation of acid attack against ferrous metals, accurately measured pieces of mild steel S.A.E. 1010, were used as the test specimens. These steel pieces were cut and ground on all sides so that the polished pieces had areas of 27-29 sq. cm. After a degreasing process in a boiling alkali-soap solution in water, the specimens were rinsed with distilled water, then with a warm 75 per cent methanol solution (pH value of 7-8), weighed, and used.

The pickling baths consisted of 600-ml. beakers containing 400 ml. of the pickling solution to be tested. The steel pieces were suspended in the pickling bath by means of glass hooks, and all the beakers were fitted with glass covers which permitted a small amount of ventilation.

The first tests were made to determine the per cent retardation obtained by using the commercial cutting oils as inhibitors for 4.9 per cent sulfuric acid. The per cent retardation is given as:

$$\text{Per cent retardation} = \frac{(\text{Rate of wt. loss, control} - \text{Rate of wt. loss, test}) \times 100}{\text{Rate of weight loss in uninhibited control acid}}$$

It is seen from Fig. 1 that increasing the concentration of cutting oil increases the retardation if the retardation in lower concentrations is sufficiently low. Likewise, the per cent retardation after 96 hours' pickling time is higher than it is after a 20-hour pickling interval, showing that the effectiveness of the inhibitor is not injured with increase in pickling time.

TABLE 1—RETARDATION IN 4.9 PER CENT H_2SO_4

Cutting oil	Vol.% added	After 20 hours: Loss in mg./sq.cm.	After 20 hours: % retard.	After 96 hours: Loss in mg./sq.cm.	After 96 hours: % retard.
A	0.1	5.4	54	5.9	86
A	0.5	2.7	77	3.7	91
B	0.1	1.2	90	3.3	92
B	0.5	1.2	90	2.9	93
C	0.1	2.1	82	4.1	90
C	0.5	2.0	83	3.7	91
D	0.05	1.4	88	4.5	89
D	0.1	0.7	94	1.7	96
E	0.1	2.1	82	7.0	83
Control	...	11.8	...	41.7	...

Since time of pickling is preferably cut to a minimum in industry, the increased speed of pickling may be obtained by increasing the acid concentration. Tests were run with typical commercial soluble cutting oils added to 25 per cent sulfuric acid as the pickling medium. Pickling times ranged from 4 to 72 hours, with the results illustrated for three of the oils in Fig. 2.

A series of pieces was used to obtain data at the various time intervals, since it was not advisable in the interest of reproducibility of results to return the cleaned and dried test pieces to the pickling bath. The few pieces which were removed, cleaned, weighed, and returned to the bath showed results comparable to the data illustrated in Figs. 1 and 2.

Since pieces are pickled from 5 to 30 minutes in industrial application, it was desirable to observe the inhibition of these cutting oils in the early stages of pickling. Due to the small weight losses of the test pieces in respect to the original weight of the pieces, the weight loss determination method was considered to be inaccurate.

In the acid attack on metals, the hydrogen gas evolution is proportional

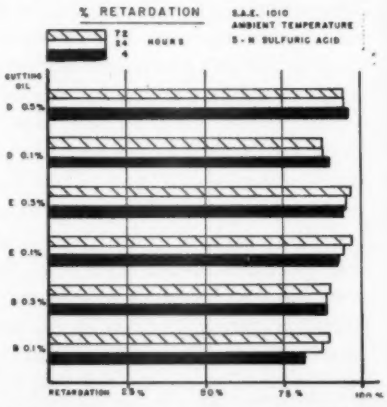

Fig. 2—Percentage cutting oil as inhibitor, versus corrosion rate.

to the weight loss of the metal, as in the following equation:

$$H_2SO_4 + Fe \rightleftharpoons FeSO_4 + H_2 \uparrow$$

Therefore, an accurate determination of the quantity of hydrogen liberated gives a continuous record of the inhibiting properties of the materials under test.

Pieces of S.A.E. 1010 steel, prepared as before, are inserted in a testing apparatus containing a gas burette as in Fig. 3. After the metal strip is introduced, the system is hooked up as illustrated with the stopcock at the top of the burette left open. About 500 ml. of the acid to be tested is thoroughly stirred and poured through the leveling bottle into the system so that the entire apparatus is filled with the acid and the upper stopcock is closed after some of the acid overflows. By keeping the acid level in the leveling bottle at the same height as the meniscus in the burette, the reading of the hydrogen gas volume is made at atmospheric pressure.

Results of hydrogen evolution tests for pickling periods of 5 to 120 minutes showed that the majority of the cutting oils tested in 0.1 per cent concentrations in 1-N and 5-N sulfuric acid had retardations over 80 per cent. The percentage retardation increased with the acid concentration.

Test pieces which had been pickled in acid to which the soluble cutting oils had been added were found to resist rerusting after the acid had been rinsed off and they were allowed to dry in the air. The test specimens which had been pickled in uninhibited acid rerusted rapidly as did specimens which were immersed in acid inhibited with various commercial inhibitors.

Two methods were employed to determine if the cutting-oil inhibitors affected the rate of rust removal in any way. In the first test a drop of the acid under test was placed on a rusted iron sheet at the same time as a drop of the uninhibited acid was placed alongside on the same sheet. The difference in time between the control acid's rate of rust removal and the inhibited acid's rate of rust removal gave a quick indication of the inhibitor effect. The spot was rinsed with water so that the condition of the derusted surface could be observed. In Fig. 4 the center spot was caused by uninhibited 1-N sulfuric acid; the other spots were the result of the same acid to which cutting oils A and D were added in 0.5 per cent concentrations. The rust was removed with equal speed on the three test spots.

In the second test, a quantitative determination, pieces of S.A.E. 1010 steel were rusted under carefully controlled conditions in a humidity cabinet. These pieces were then split into two parts and one part was used in the pickling tests, whereas the other part was quantitatively analyzed for the rust content. The rust was determined by boiling the previously weighed rusted piece in a sodium hydroxide solution to which zinc dust had been added. After the rust was removed the piece was dried and weighed.

Weight determinations of the rate of rust removal were made when using inhibited and uninhibited sulfuric acids. The rate of rust removal was not affected to an appreciable degree by the presence of the cutting-oil inhibitors and the acid attack on the base metal was sharply retarded.

The results of these tests indicate that the oil companies should investigate the suitability of their soluble cutting oils for acid pickling inhibition.

One pickling inhibiting cutting oil tested is of special interest to the oil industry due to its corrosion-inhibiting properties, as a cutting oil, as a fuel additive for corrosion prevention, and as a textile lubricant. This compound, known as H 136, exhibited retardations over 83 per cent when added to 5 per cent sulfuric acid in concentrations of 0.01 per cent by volume. Pickling times ranged from 15 minutes to 48 hours.

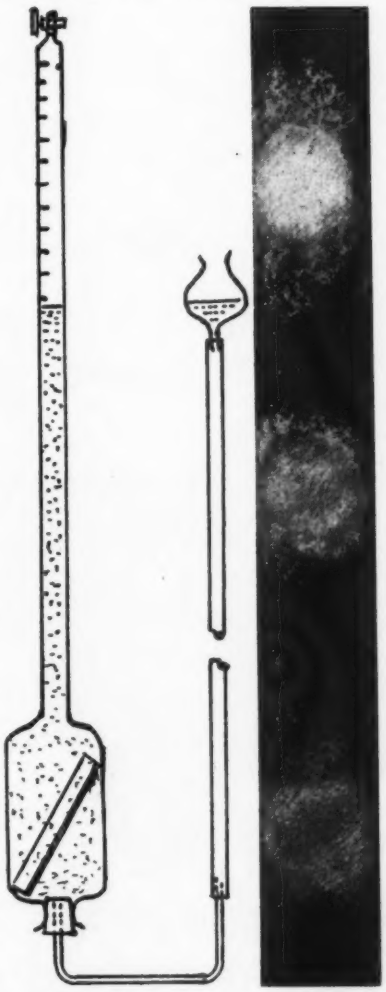

Fig. 3—(Left) Hydrogen evolution apparatus. Fig. 4—(Right) Center spot caused by uninhibited 1-N sulfuric acid; the other spots were the result of the same acid to which cutting oils A and D were added in 0.5 per cent concentrations.

This inhibitor is the sodium salt of a saturated hydrocarbon-sulfamido-carboxylic acid. The starting material in its manufacture is a by-product of the Fischer-Tropsch synthesis. It is a certain fraction of saturated hydrocarbons having a chain length of 12-18 carbon atoms which has too high a boiling point for motor fuels and is unsuitable for lubricants. The oil industry which has such materials as byproducts, or can saturate the unsaturated hydrocarbons of this chain length, can synthesize this new cutting oil-inhibitor in the following manner:

This starting material, called "Mepasin," is treated with ½ mol each of sulfurdioxide and chlorine at 30°-60° C. in the presence of ultraviolet light in order to produce the monosulfochlorides of these hydrocarbons. When about 50 per cent of the Mepasins are converted the reaction must be stopped because if the sulfochlorination is continued, the output of mepasinsulfochloride is not increased but the reaction product varies by formation of higher sulfochlorinated products.

The mepasinsulfochlorides are in turn transformed to "Mepamides" (sulfamides) by reaction with ammonia at 20° C. and at one atmosphere pressure. After heating these mepamides with monochloroacetic acid, the mepasin-sulfamido-acetic acid is formed. The sodium salt is easily produced and the pH is adjusted to just above 7 by the addition of sodium hydroxide. The final product is a mixture of the mepasin-sulfamido-carboxylic acid sodium salt and unreacted mepasin oil.

Tests have shown that this compound can serve as an excellent inhibitor for product pipe lines. The addition of 0.02 per cent H 136 to leaded or white gasoline to which 10 per cent of a 3 per cent salt-water solution has been added prevents the corrosion attacks of this combination on iron and steel even after 1 year. The addition of 0.006 per cent of H 136 to a leaded gasoline (containing a small sump of water) prevented the rusting of polished mild steel coupons.

The H 136 protects metals against corrosion by the formation of an adherent monomolecular film on metal surface. Interesting feature of the inhibitor is its solubility in organic compounds and its emulsifiability in water. When introduced in product pipe lines or storage tanks, the H 136 which is soluble in the organic contents will dissolve in the water sump or in the suspended water and protect ferrous metals from corrosion.

In times of emergency derusting of

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PRECISION BUILT FIELD PROVEN PUMPS

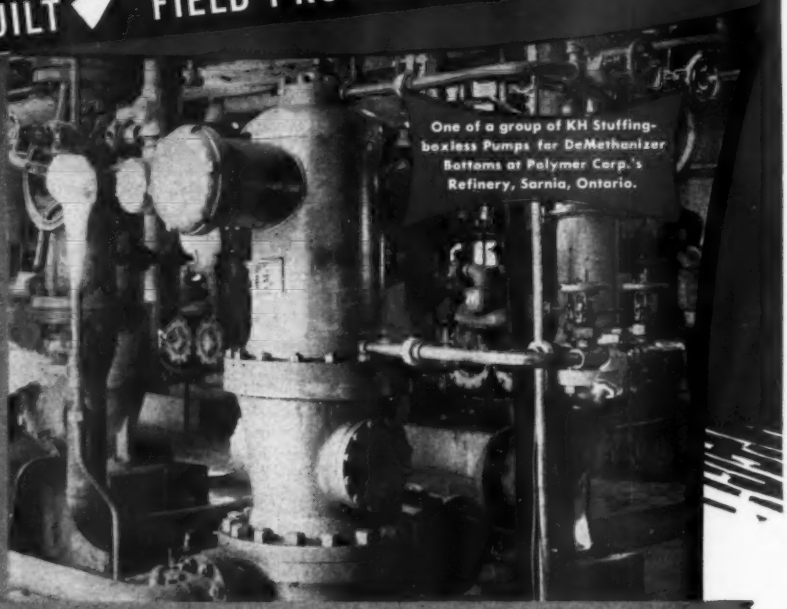
Stuffingboxless Pumps

Bingham Stuffingboxless Pumps are EXPLOSION PROOF and LEAK PROOF. This means SAFETY for plant personnel, PROTECTION against fire and PREVENTION against loss of valuable pumpage. These pumps can be furnished for any suction pressure...for any pumping temperature.

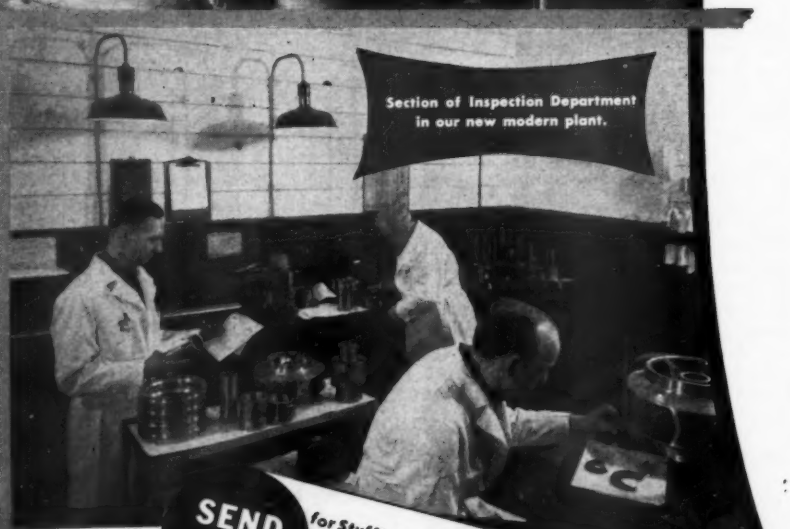
Bingham Stuffingboxless Pumps are especially adapted for and are giving exceptional service in many types of industry such as *Oil Refineries, Synthetic Rubber and Plastics industries, Natural Gasoline plants, Pipeline Booster stations, Terminal and Storage Tank Farms, Chemical plants, Food Processing industries, heavy construction and industrial applications.*

• • •

Bingham Stuffingboxless Pumps, like all Bingham products, are precision built. Each part is subjected to rigid inspection by expert craftsmen.



One of a group of KH Stuffingboxless Pumps for DeMethanizer Bottoms at Polymer Corp.'s Refinery, Sarnia, Ontario.



Section of Inspection Department in our new modern plant.

SEND NOW for Stuffingboxless Folder No. 107

Lists 12 important reasons why you can profit by using Bingham Stuffingboxless Pumps. Wire, write, or phone the Bingham Sales and Service office nearest you.

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equipment, soluble cutting oils can be used as acid pickling inhibitors with additional protection against rerusting of the pickled equipment for a short time. A new cutting oil which could be synthesized from an oil-industry byproduct should also be investigated as a product pipe-line and storage-tank inhibitor and for a variety of other uses.

Flange, Gasket, and Bolting Materials

(Continued from page 140)

tion of gasket characteristics. The "gasket seating stress," which is independent of the confined pressure and indicates a minimum stress that must be applied to the gasket to hold any pressure, is a measure of the force which must be applied to the gasket contact area to make the gasket material yield, flow, and seal. The "gasket factor" is the ratio between seating stress and internal pressure. For practical purposes this factor is a constant throughout a wide range of pressures for gaskets of given construction.

The seating stress and gasket factor values depend upon hardness, resilience, and dimensions. A.S.M.E. and others have published tables of yield point and gasket factors for common materials. Values given in each instance are arbitrary and based upon values which have proved satisfactory in service. As these values may vary greatly just due to different methods of manufacturer using identical materials, they should be taken as suggested values only and in critical design instances test values should be obtained directly from the gasket manufacturer on the actual gaskets to be used.

In actual practice most refinery gasket specifications boil down to three or four gasket types of standard sizes utilizing three major materials for all ordinary applications.

The service-sheet ring gasket $\frac{1}{16}$-in. thick is practically a standard specification for general hydrocarbon and other service in 150 and 300-lb. flange ranges at temperatures up to 450° F.

There is a divided opinion on the best type of gasket in the 150-300-lb. flange range above 450° F. Up until about 10 years ago it was normal to specify a corrugated-iron, asbestos-filled, double-jacketed gasket for higher temperatures. Several major companies still hold to this practice.

In recent years the development of the spiral wound "Spirotallic" or "Flexitalic" style gasket has led many users to specify this type gasket for temperature service above the 450° F. range. It is made up of thin strips of asbestos and steel wound spirally together. A mild steel is satisfactory up to 500° F., Type 304 stainless being recommended from 500° to 850° F., and a Type 309 stainless is used for temperature above 850° F. This type gasket is usually somewhat narrower than the flange raised face and has approximately the same gasket factor as the asbestos service sheet. It is considerably lower than the jacketed-type gasket. This gasket is especially applicable where extreme variation is expected in pressure or temperature conditions at the joint.

Almost without exception, ring-type joints are used for all flanges of 600-lb. A.S.A. rating and above. In instances where it is necessary to flange equipment having a raised face terminal flange, the spiral-wound gasket with soft-steel retainer ring has been found satisfactory in many applications.

Rings for ring-type joints are specified in soft iron up to about 950° F. where a Type 502 (4-6 per cent chrome, ½ per cent moly) material is required. It is usually only when temperatures above 1,200° F. are expected or corrosion is exceptionally severe that a Type 410 (11-13 per cent chrome) or Type 304 (18 per cent chrome, 8 per cent nickel) is warranted. As there is considerable difference in the gasket factor of the three materials it is advantageous to specify the softest of the three most suitable for the given service conditions.

Fig. 3 is based on values for gasket factor and gasket yield as suggested by Taylor. This figure shows the effect of gasket width on bolt loading

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HERE'S MOTOR QUALITY, INSIDE AND OUT . . . TO CUT YOUR PUMPING COSTS . . .
Electric well pumping means R & M motors to men who want trouble-free service. These motors are made to outsmart the weather. Uncovered, outdoors, they stay dry inside, yet they won't overheat in the hottest sun. They're rugged, cool-running—always ready to go. Lubrication? Only once in five years.
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Rust can be stopped . . . stopped easily, surely, economically! RUST-OLEUM is the answer. For 25 years it has proved its capacity to stop and prevent rust at sea, in the oil fields, in fume-choked industrial areas, on railroad rolling stock, bridges and signaling equipment.

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RUST-OLEUM decorates as well as protects. It is available in all colors, aluminum and white. It can be applied to metal where rust has already started. You don't have to remove all the rust.

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for a 6-in., 600-lb. flange. The 1¼-in. width is standard for this flange. Service sheet gasket width is rarely varied except in large-diameter or special-design flanges.

Fig. 4 shows expected bolt loading using A.S.M.E. suggested values for yield and gasket factor. The flange design bolt load divided by the allowable bolt design stress gives the net bolt area required for a joint. This chart is an indication of relative bolt strength required for various gasket materials for standard flanges. This relationship is particularly important when actually making up the flange joint as it is also an indication of the relative bolt force required to make a tight joint. In construction experience it has been found that more leaky joints result from abuse and over tightening than from insufficient bolt force. Once a gasket is crushed it must be replaced to make a joint. If one is too loose and leaks on test it can usually be tightened up and made to hold.

Summary

Temperatures and corrosive nature of application are the most important operating variables influencing flange, gasket, and bolting-material selection. Design pressure is of course important to material selection of all three but is possibly more critical to the flange itself.

The bolting provided sets the upper limit for gasket hardness by limiting the force available for yielding the gasket and maintaining a tight joint. Gasket dimensions of course may be varied to compensate for bolt stress limitations to some extent.

Metallic gaskets can not compensate for cocked flanges, damaged faces, or nonuniform bolting to the same extent possible by softer materials.

It is important that flange bolts be tightened uniformly in sequence and equally stressed with final loading applied in small steps if distortion is to be avoided.

Both gaskets and bolts are cheap when compared to other items in a piping assembly. In each instance the best material for the service should be specified. If in doubt use the next best material. Most joint components actually work above their design stress values due to lack of knowledge of actual line stresses and lack of control over bolt-tightening procedure and practice.

Actual material specification and gasket-type selection is done by all designers on a basis of experience within code limitations. Differences of opinion have developed through variations in experience, and design values particularly for gaskets, vary from company to company. The design values supplied by the manufacturer are ordinarily the designer's best source of information, particularly when tempered with actual past experience using similar materials.

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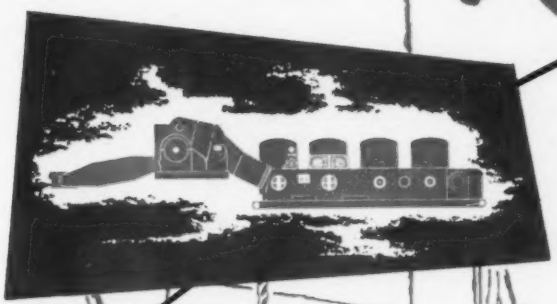
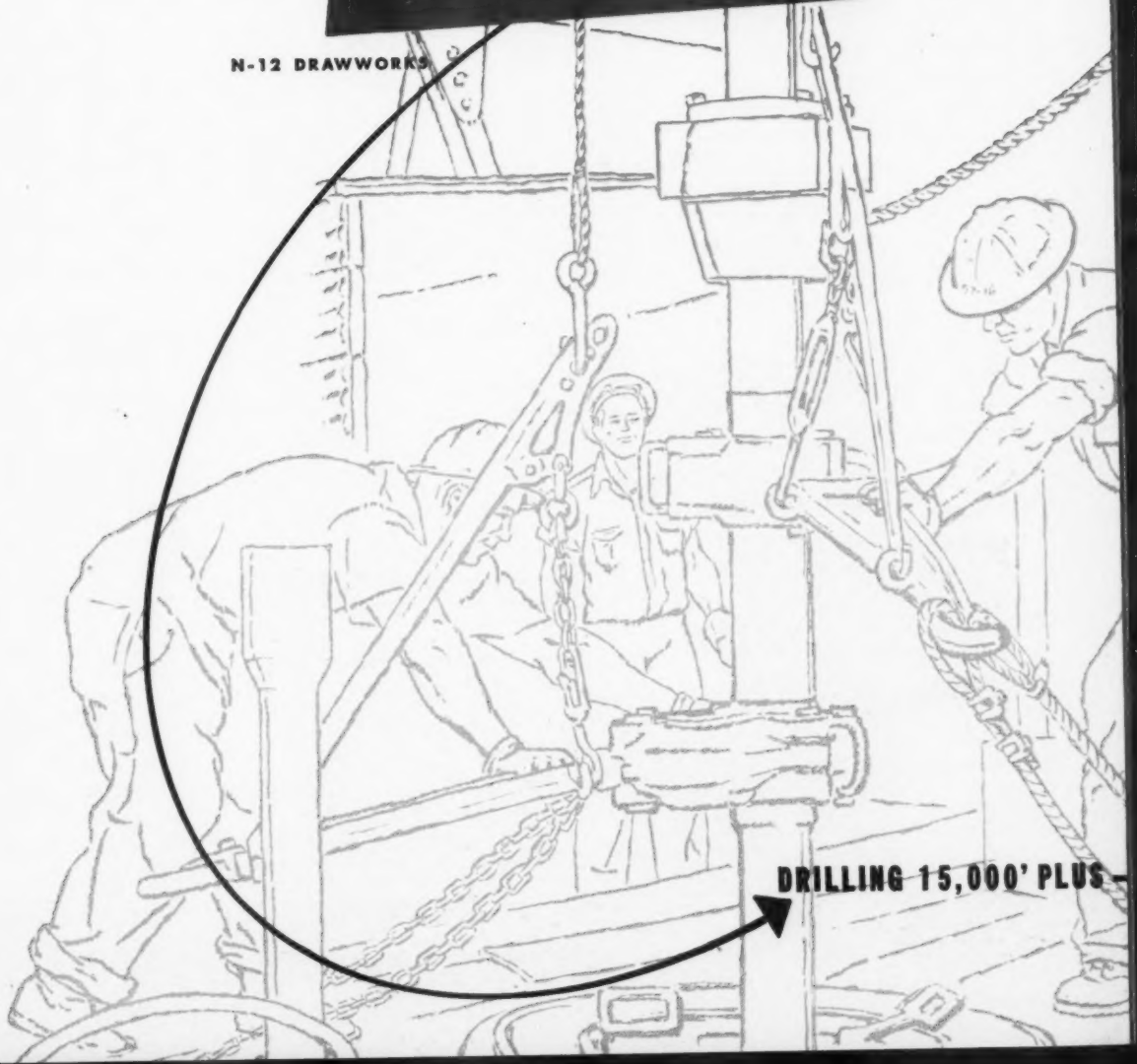
THE MOST TALKED ABOUT RIG IN THE INDUSTRY

BREWSTER'S Golden Rig



N-12 DRAWWORKS



DRILLING 15,000' PLUS

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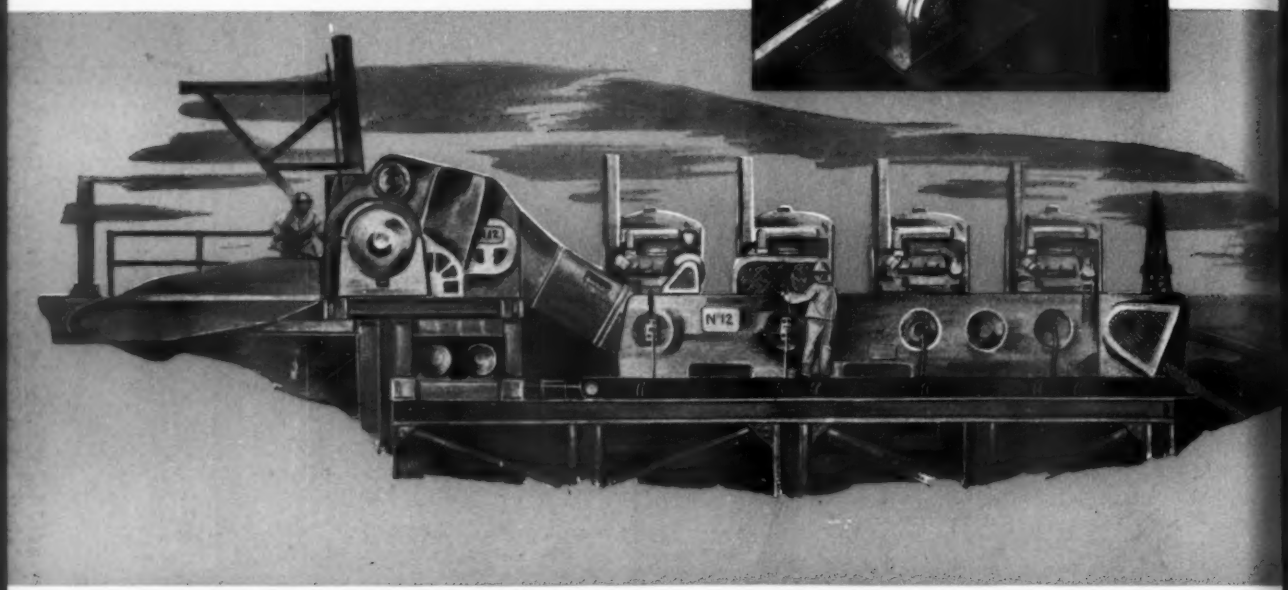
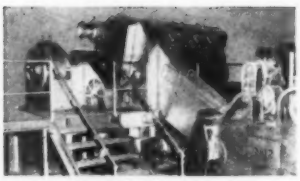
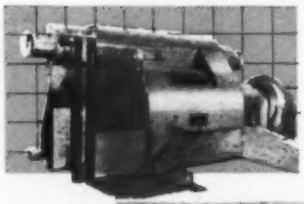
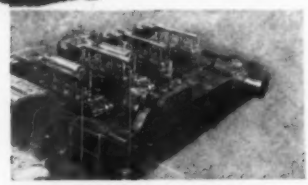
BREWSTER N12 DRAWWORKS

The latest achievement of Brewster engineering, powered with a total of 1600 horsepower for drilling 15,000 feet and more









BREWSTER-ENGINEERED FOR SIMPLE CONTROL AND ECONOMICAL USE OF POWER

DRUM SHAFT—10" alloy steel, heat treated for maximum strength and toughness.

BRAKES—10" wide, 54" diameter, water cooled, 325° wrap lining.

DRUM CORE—28" diameter of thick wall cast steel, heavily ribbed to prevent crushing.

FRICTION CLUTCH DRUM DRIVES—High and low speed with power ratio of 3.92/1.

DRUM CLUTCHES—Standard air operated, plate type. Low drum clutch is 42"-2 plate. High drum clutch is 30"-3 plate.

DRUM DRIVE CHAIN—2" pitch triple high speed roller type.

DRUM SHAFT BEARINGS—Self-aligning roller type. Each bearing has 270,000 pounds static load capacity.

DRUM SPEEDS—8 forward, 2 reverse. Line speeds from 285'/min. Line pulls, 126,000 pounds to 10,700 pounds.

ROTARY SPEEDS—Overall speeds of 8.65 to 1 as 500 RPM to 562 RPM.

CATHEAD SPEEDS—4 speeds forward—98.5 RPM to 304.2 RPM.

TRANSMISSION—Enlarged version of Brewster field-proven chain transmission

SUPPLY HOUSES:
Apex Equipment Company
Bovaird Supply Company
Industrial Supply Company
Murray Brooks, Inc.
Reams Supply Company

IN CANADA AT:
Rocky Mountain Supply Company

Since 1910—Manufacturers of Fine Drilling Equipment

BREWSTER COMPANY

SHREVEPORT, LOUISIANA

BREWSTER MATCHED Drilling Equipment

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BREWSTER N12 DRAWWORKS SPECIFICATIONS

Drum Speed	Line Speed	Line Pull	Rotary Speed
34.4 RPM	285'/min.	126,000#	56.2
50.1	416	89,000#	83.5
72.6	603	59,000#	122.0
105.9	880	42,000#	177.0
135.5	1,126	31,000#	162.0
197.8	1,644	22,700#	236.0
286.5	2,381	15,300#	341.0
418.2	3,476	10,700#	500.0

TRANSMISSION

4 speeds forward—1 speed reverse—2" P. triple chain, 174,000# breaking strength—24T minimum sprocket size—1672'/min., max. chain speed—shaft bearings—SKF 2232, 6-5/16 I.D., 232,000# capacity.

GENERAL SPECIFICATIONS

All block clutch drives inside transmission case.

Friction clutches all outside for service accessibility.

All operating clutches air operated.

All chains run in oil-tight guards with oil pressure lubrication.

All shafts mounted on roller bearings with oil pressure lubrication.

Rotary drive chain 1½" P. double chain.

Cathead drive chain 2" P. double chain

2—oil pumps individually driven for safety.

Oil-tight flexible guard to compound.

N-12 COMPOUND SPECIFICATIONS

CHAINS:

Drawworks drive 1½" P. quad.
Between motors 1½" P. quad.
Pump drives 1½" P. sextuplet.

CLUTCHES:

Fawick to fit motor.
30 x 525 Fawicks on pump drives.
Positive clutch on each motor shaft for distribution of power to drawworks and pump.

All chains and bearings lubricated with oil from pumps.

Both pump drives rated 850 H.P. each for biggest mud pump.

Oilbath box constructed of ¾" and ½" plate.

All shafts and sprockets mounted on roller bearings.

Drives provided for 2 air compressors and 1 generator.

Motor throttles air operated by driller.

Motor tachometers mounted in control panel at driller's position.

N-12 Matched Equipment

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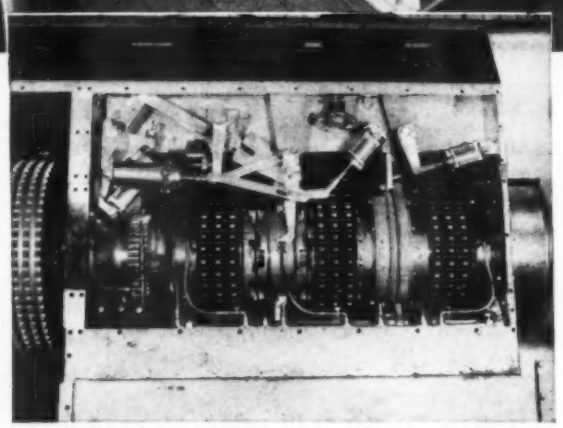
Brewster N-12 Drawworks needed HARNESS FOR 1600 HORSEPOWER!



LINK-BELT ROLLER CHAIN IS IT!

The transmission of this gigantic rig gives eight forward drum speeds and eight rotary speeds, but requires no more space than the conventional six speed job. Transmission uses Link-Belt 2″ pitch triple width roller chain on all forward speed drives.

Compound is equipped to drive two of the largest modern slush pumps through Link-Belt 1½″ pitch sextuple width roller chains to countershafts.

More than 70 years of chain improvements have made Link-Belt top performer among roller chains . . . and the choice of manufacturers and operators alike.

LINK-BELT

Precision Steel

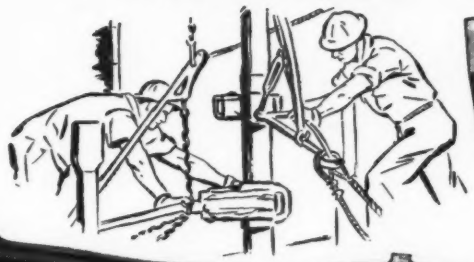
ROLLER CHAIN

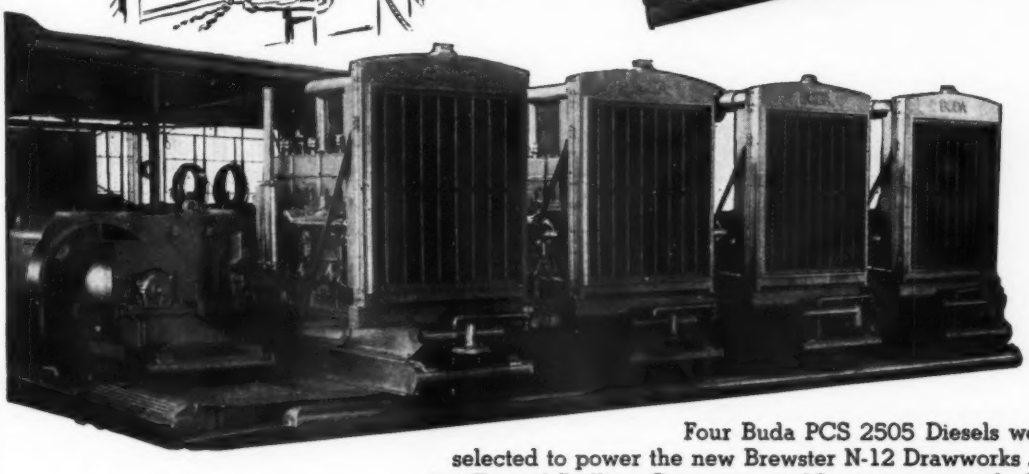
LINK-BELT COMPANY 12,085

Indianapolis 6, Dallas 1, Houston 1, Kansas City 8, Mo., Los Angeles 33, New York 7, Toronto 8.

You see 4 BUDA engines .... Actually There are 12

on the New Brewster N-12 Drawworks





Four Buda PCS 2505 Diesels were selected to power the new Brewster N-12 Drawworks . . . but Penrod Drilling Company got 12 engines instead of 4!

A new Buda development—the "Fuecomizer Package Kit" permits conversion of these Buda Diesels to Gas or Butane (or vice-versa) operation with minimum down-time. The Buda "Fuecomizer Kit" gives Penrod Drilling the chance to choose the most economical or more readily available fuel . . . Diesel, Gas or Butane . . . in effect, giving Penrod 3 engines for every 1 they have.

This new versatility, plus the reputation of Buda Diesels for advanced design, economical service and dependability make Buda Diesels with their "Fuecomizer Package Kit" well worth investigating. Get the facts today from your nearby Buda Oil Field Engine Distributor, or write for complete details. The Buda Company, Harvey, Illinois.

a Power-full name in Engines... **BUDA**

80-12

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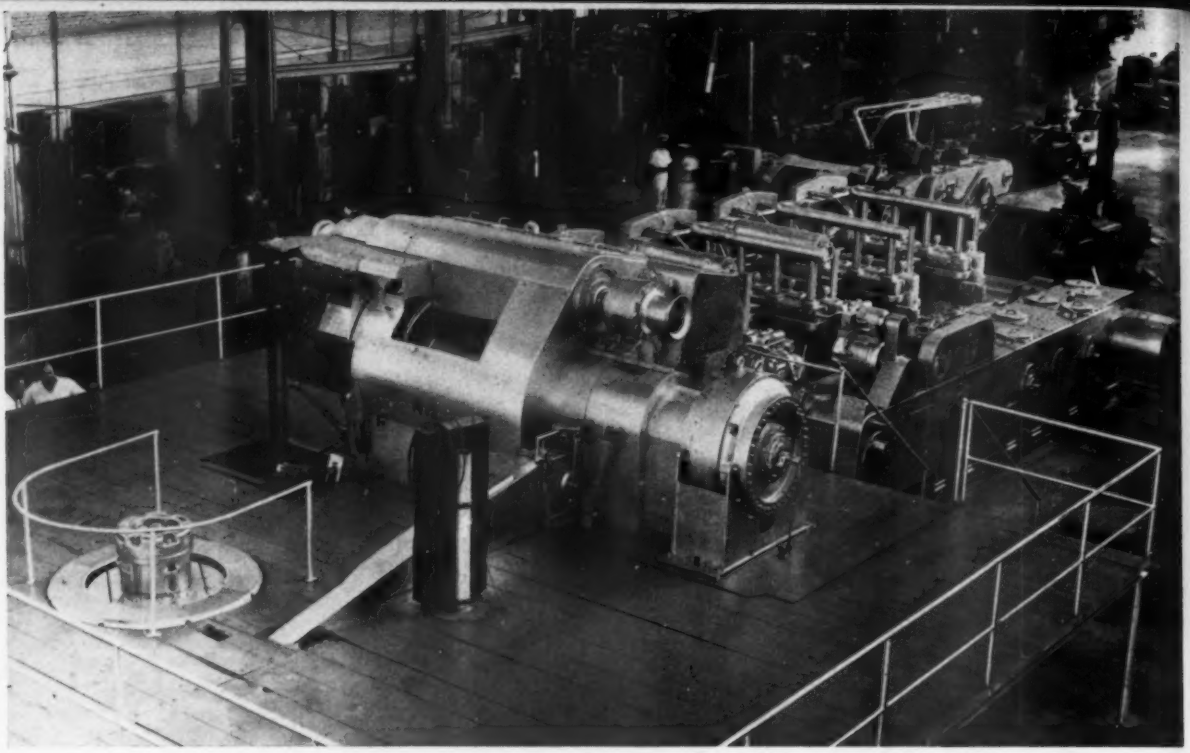


The N-12 is a husky, heavy-duty r'g engineered to drill to any of the present producing depths in the United States.

BREWSTER'S NEW RIG DESIGNED FOR

15,000-FT.-PLUS DRILLING

Unit takes advantage of new developments in pumps, bits, clutches, brakes, air controls, and standard parts

by J. T. Carmichael*

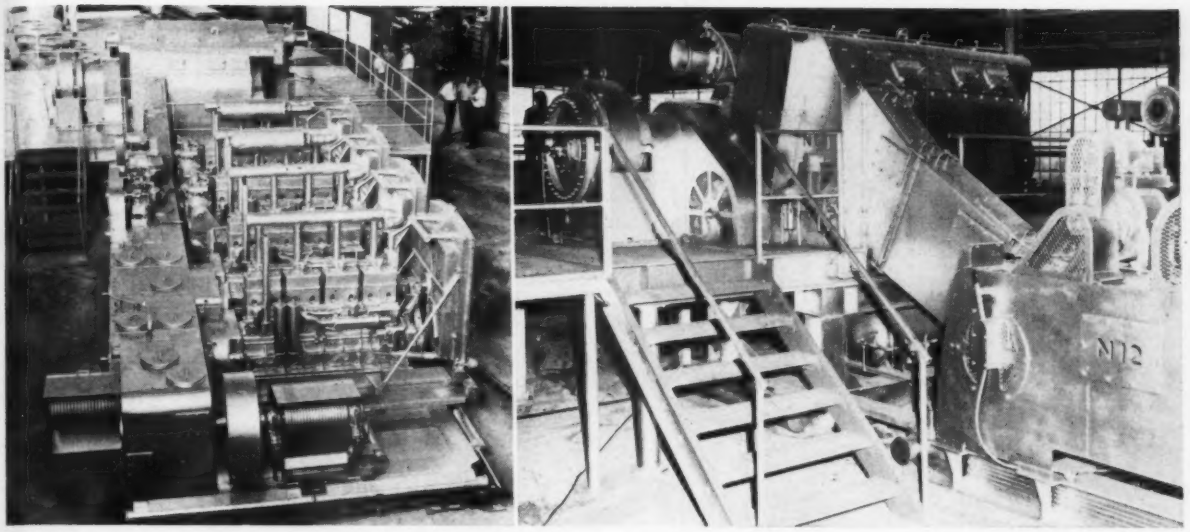
Detail of the four 500-hp. prime movers and their auxiliary equipment.

THE new Brewster Co. N-12 drilling rig—largest ever built by the company—is designed for the drilling of wells 15,000 ft. or deeper.

The N-12 has been designed along the same general principles which have been used in the design of Brewster's existing line of drilling rigs. It is primarily an adaptation of the same design principles used for the smaller rigs, on a larger scale. Two and one-half years were spent in designing and manufacturing the first N-12. It was designed with the Gulf Coast and West Texas areas in mind, particularly. The wide speed range on the rotary is advantageous for areas such as these where a wide variety of formations are drilled. The rig can drill to any of the present producing depths in the United States. The two 850-hp. pump drives are also particularly suited to the Gulf Coast area where pump horsepower is an important factor. The increasingly wide use of jet bits is a strong factor in this importance of horsepower.

The designers feel that this rig is properly equipped to take full advan-

*Chief engineer, Brewster Co.



Left: View of engines and power-transmission train. Right: Photo showing detail of power transmission and rear of draw works.

tage of the new developments of the past few years in bits, pumps, and mud conditions. It embodies the latest designs in friction clutches, hydramatic brakes, lubricating systems, catheads, and air controls.

Where possible, throughout the rig, standard brands and standard-size component parts, such as friction clutches, bearings, and chains have been used. This has been done to simplify maintenance and repair problems. Full advantage has been taken of the latest developments in steel alloys for such parts as brake drums, sprockets, and clutch parts. All foundry work for the rig parts was done in Brewster's own steel foundry.

The new N-12 rig is equipped with four Buda engines. The engines are Buda's new model PCS-2505 which develops 500 hp. at 1,200 r.p.m. These new prime movers are equipped with a "Feucomizer" Kit which makes them capable of burning any type of fuel.

The rig has eight drum speeds forward and two in reverse. This is in contrast to the more conventional six speeds forward in a rig of this size. The N-12 has been designed to fit on three skid-mounted sections to insure a high degree of portability. All operations of the rig are controlled from a single panel by means of compressed-air controls.

Line speed, line pull and rotary speed for given drum speeds are as follows for the new rig:

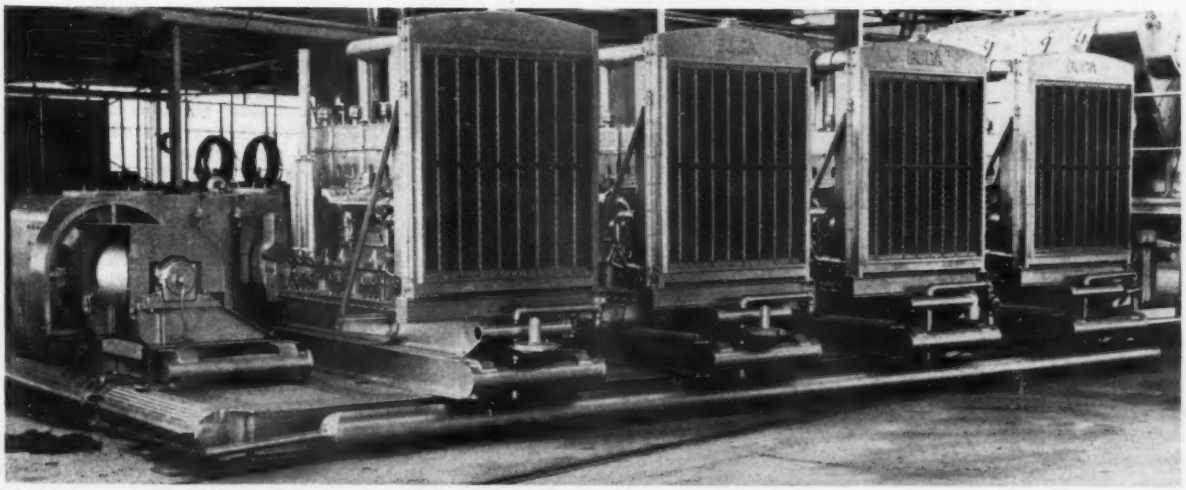
Drum speed (r.p.m.)	Line speed ft. per min.	Line pull (16)	Rotary speed (r.p.m.)
34.4	285	126,000	41 2
50.1	416	89,000	59.8
72.6	603	59,000	86.7
105.9	880	42,000	126.7
135.5	1,126	31,000	115.9
197.8	1,644	22,700	169.4
286.5	2,381	15,300	245
418.2	3,476	10,700	357

The transmission has four speeds forward and one speed in reverse. It utilizes a 2-in.-pitch triple chain with a 174,000-lb. breaking strength. Minimum sprocket size is 24 teeth and the maximum chain speed is 1,672 ft. per minute. The N-12 compound provides two 850-hp. pump-driven air compressors, one thyrite generator drive, and one washdown pump drive. The draw-works drive chains are 1½-in.-pitch quadruple; the chains between motors 1½-in.-pitch quadruple; and those on the pump drives are 1½-in.-pitch sextuplet. All operating clutches are air operated. There is a positive clutch on each motor shaft for the distribution of power to draw works and pumps. The air-type friction master clutch is mounted on the outside of the compound case for accessibility, and is used only in changing transmission speeds.

All chains and bearings are pressure lubricated with oil. Both pump

(Continued on page 158)

Engines are arranged in individual skid units; the complete power plant assembly is also designed on unitized basis.



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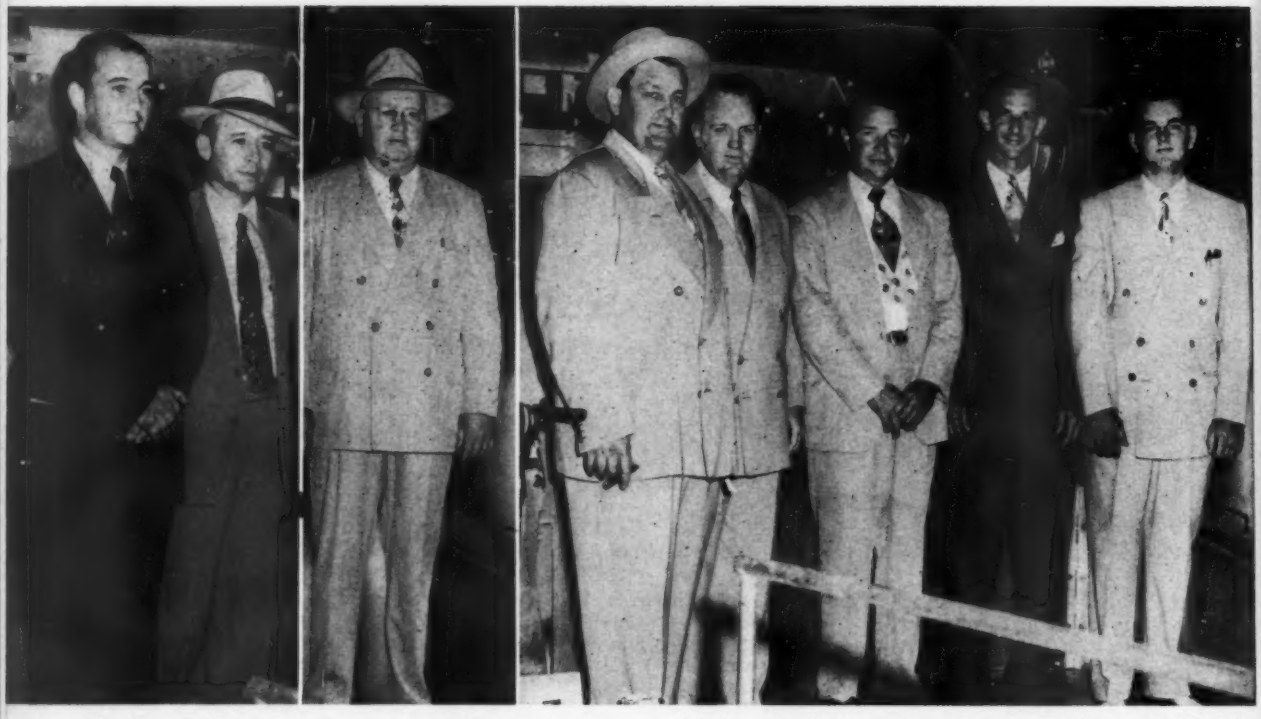


Left: Harry B. Marioneaux, vice president and general manager, and J. T. Carmichael, chief engineer, Brewster Co. Center: A. Olin Price, vice president and assistant manager, Brewster Co. Right: Phil Parker, sales manager; Ervin Auxter, J. H. Almand, J. D. Johnston, Jr., and Jerry Price, salesmen; all of Brewster Co.

1,000 Oil Men View Rig Unveiled at Shreveport

Several manufacturers participate in open house

Left: Walter Brown, design engineer, Brewster Co. Right: Jerry Price, Brewster Co.; A. R. Collins, Kansas City Southern Railroad; and James H. Collins, drilling superintendent, C. E. O'Neal & Co., Evansville, Ind.

OVER a thousand drilling industry men attended the recent week-long Brewster Co. open house to view the company's newest drilling rig—the N-12. The 5 days of open house started with a big barbecue and continued through the week. The new rig was completely painted in gold for the occasion.

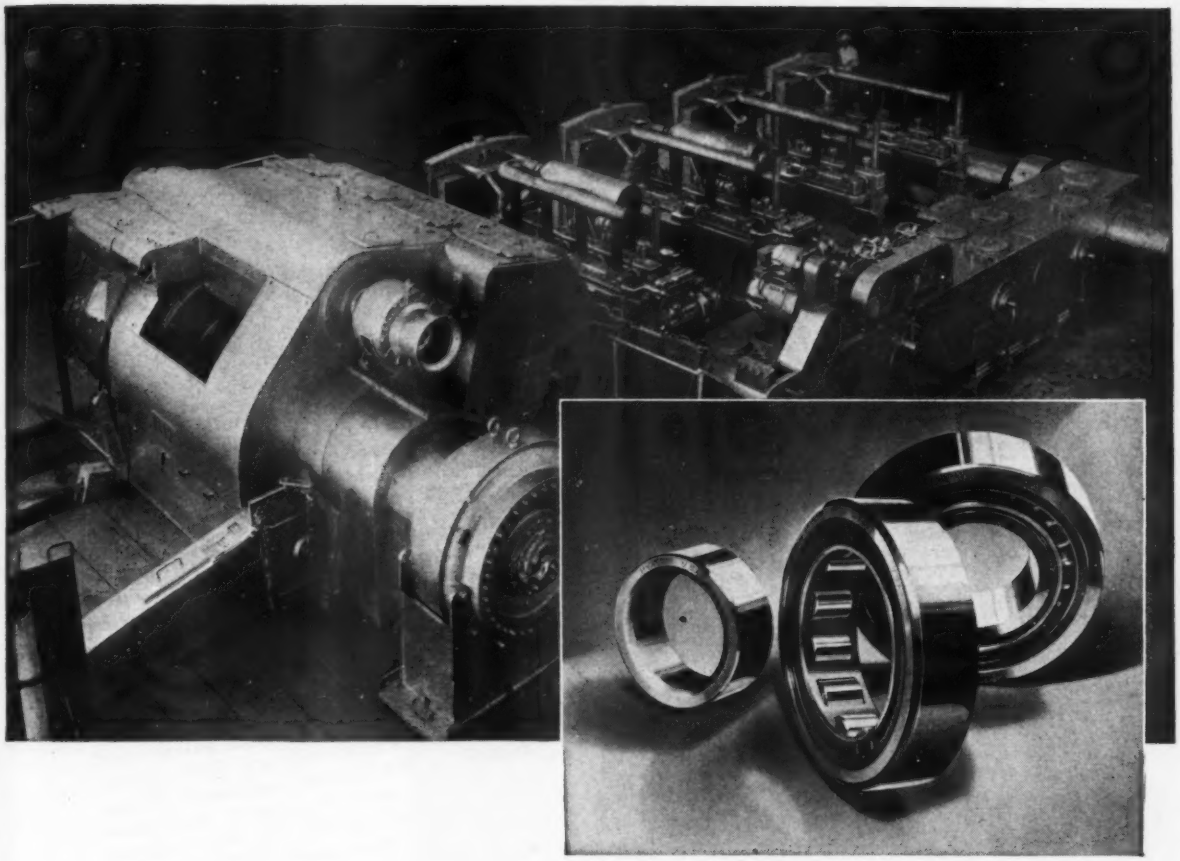
Several other manufacturers cooperated in the open house by displaying their products. Products on display included: Shaffer hydraulic cellar control gate; Moneco catheads; Gardner-Denver GXR, 7½ by 18, 650-hp. slush pump; Wilson-Snyder 7¼ by 18, Type 218P slush pump; Wilson-Snyder Type 14P-HD, 7¼ by 14 slush pump; Brewster N-7 rig; and a complete line of Brewster swivels, hooks, blocks, and rotary tables.

Brewster has been making drilling equipment since the late H. C. Brewster opened a machine shop in the Oil City, Pa., field in 1910. The company moved to Shreveport in 1915 and, a few years later, developed its first rotary drilling equipment. Today, Brewster is recognized as one of the four top manufacturers of drilling equipment in the country.

Brewster products include four sizes of draw works and complete lines of rotaries, traveling blocks, crown blocks, swivels, sand reels, well heads, drilling masts, and winches.

The main Brewster plant, where the N-12 rig was built, is on North Market Street in Shreveport in modern buildings covering 200,000 sq. ft. In

XUM



Hyatt Hy-Loads in the N-12

Leading makes and types of oil field equipment have their quota of Hyatt Hy-Loads and we are happy to include the new Brewster N-12 Drawworks among them.

Because Hyatt Roller Bearings have served long and well in Brewster products, as they have in all other equally-known quality equipment, it was but natural that Brewster would continue to use Hyatts in their latest and largest rig.

Therefore, we take this opportunity to congratulate Brewster on this new drawworks, for like all petroleum machinery builders and users too, they know that when dependable bearings are needed to carry loads, to provide smooth running shafts or wheels, Hyatts fill the requirements. Hyatt Bearings Division, General Motors Corporation, Harrison, New Jersey; Chicago, Detroit, Pittsburgh, and Oakland, California.

HYATT ROLLER BEARINGS

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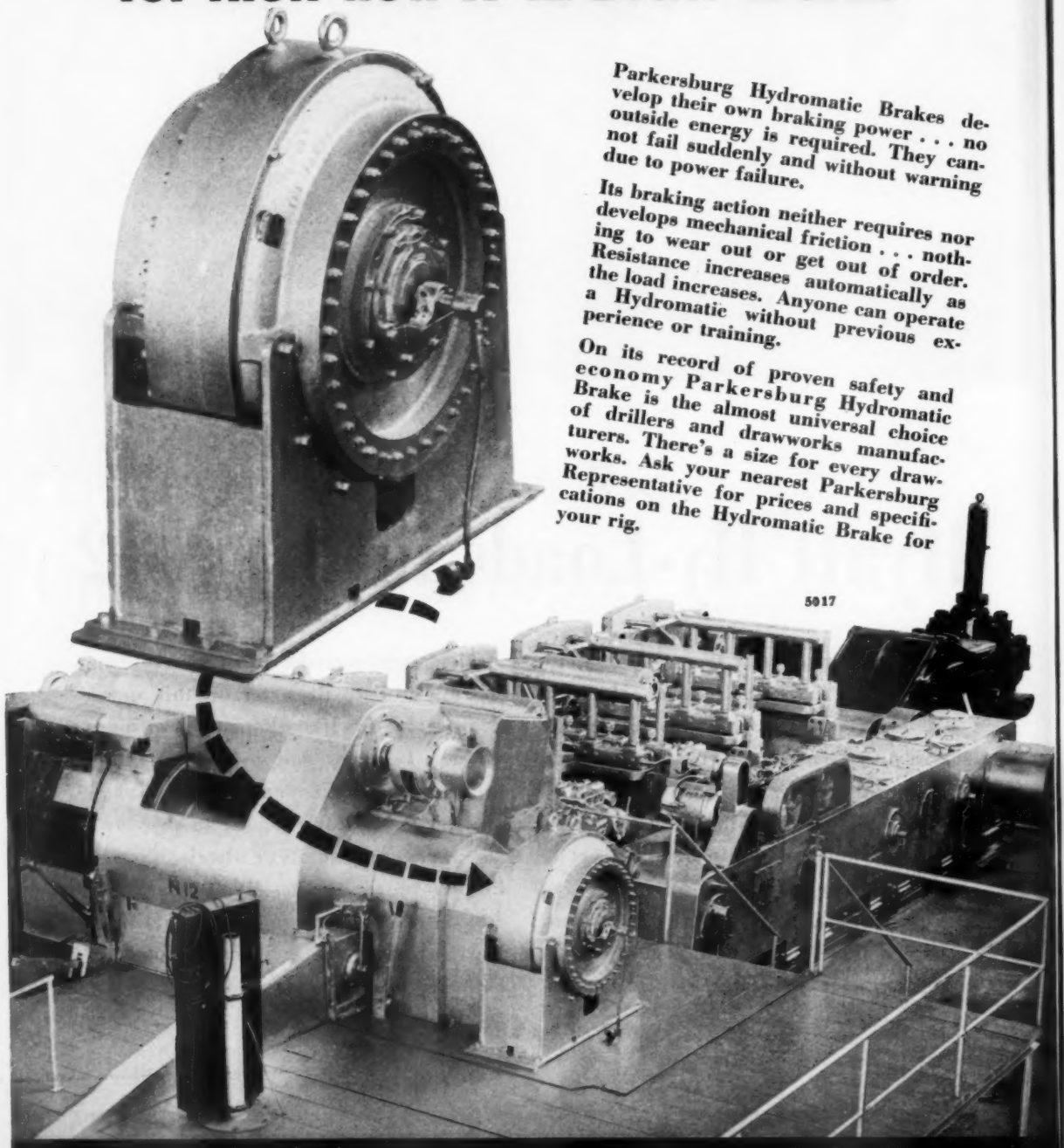
BREWSTER

CHOOSES PARKERSBURG HYDROMATIC BRAKE for their new N-12 Draw Works



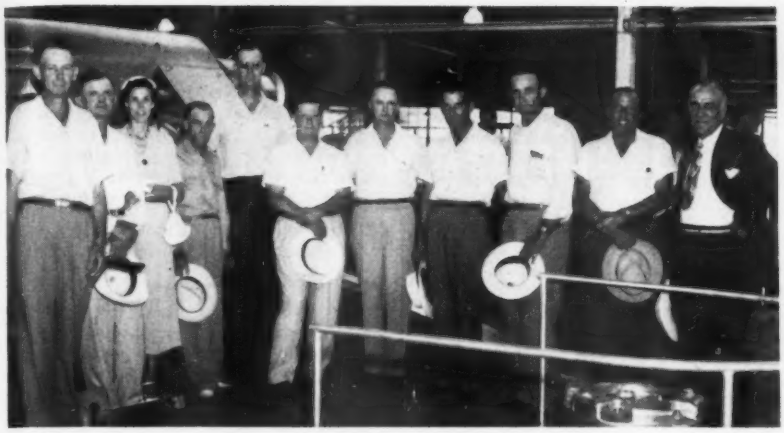
Parkersburg Hydromatic Brakes develop their own braking power . . . no outside energy is required. They cannot fail suddenly and without warning due to power failure.

Its braking action neither requires nor develops mechanical friction . . . nothing to wear out or get out of order. Resistance increases automatically as the load increases. Anyone can operate a Hydromatic without previous experience or training.

On its record of proven safety and economy Parkersburg Hydromatic Brake is the almost universal choice of drillers and drawworks manufacturers. There's a size for every draw-works. Ask your nearest Parkersburg Representative for prices and specifications on the Hydromatic Brake for your rig.

PARKERSBURG

RIG & REEL COMPANY • Parkersburg, West Virginia



A. R. Collins, D. C. S. Railways; J. H. Collins, C. E. O'Neal Drilling Co.; Mrs. J. H. Collins; J. B. Jones, George & Jones Drilling Co.; T. E. Hamiter, Pacific Wire Rope Co.; F. E. Wimberly, Sabine Drilling Co.; E. D. Rhea, L. M. Rhea, Wheless Drilling Co.; J. T. Sawyer, Kemp Drilling Co.; N. H. Hall, Penrod Drilling Co.; C. A. McDowell, Union Producing Co.

addition, the company has its own foundry at another Shreveport location.

Brewster equipment is sold in the United States through Apex Equipment Co., Bovaird Supply Co., Industrial Supply Co., Murray Brooks, Inc., and Reams Supply Co. Canadian sales are handled through Rocky Mountain Supply Co.

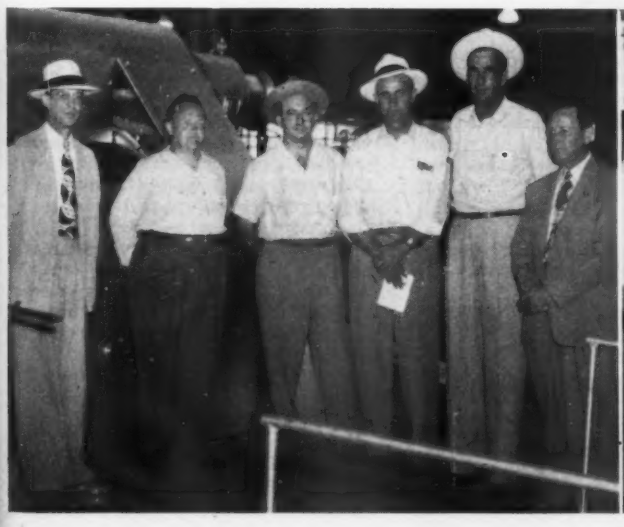
Heading Brewster Co. is Harry B. Marioneaux, vice president and general manager. He is a grandson of H. C. Brewster, the company's founder. He started his company career in the shop department before World War II. During the war he served with the Army Air Corps. He has been vice president and general manager of the company since 1946. During Marioneaux's tenure as general manager, Brewster has expanded its line of drilling equipment and has converted a war-built bomb plant to the manufacture of drilling equipment.

Phil Parker, sales manager of Brewster Co., was born and raised in Oklahoma. He has been in the drilling business since the age of 16. He worked all over the South and Southwest for many years. His experience includes a period as tool pusher for Penrod Drilling Co. and a job as drilling superintendent for Grady Vaughn of Dallas. He came to Brewster on the first day of 1947.

James T. Carmichael, chief engineer, only recently returned to Brewster as chief engineer after being with Penrod Drilling Co. for 18 months as machinery engineer. Carmichael had been with Brewster 10 years prior to his association with Penrod and served as the company's chief engineer for 3 of those years. He graduated from Georgia Tech in 1936 in mechanical engineering and was on the engineering staff of Beaird Co., Shreveport, prior to his connection with Brewster.

R. L. McLain, Gardner-Denver; Vic Martzell, Rosenbloom Pipe & Supply; Nick Wheless, Wheless Drilling Co.; G. H. Burnham, Tri-State Oil Tool Co.; Jim Smallwood, Wheless Drilling Co.; J. E. Plemons, Shaffer Tool Works.

Left: Paul M. Griffis, vice president, First National Bank, Shreveport; G. H. Jett, Kemp Drilling Co.; H. B. Johnson, Butler Johnson Service Co.; J. T. Sawyer, Kemp Drilling Co.; J. D. Halbert, Sabine Drilling Co.; Ira Bicknell, assistant vice president, First National Bank. Right: W. J. O'Brien, Rex Drilling Co.; J. C. Phillips, Gulf Oil Corp.; J. M. Sterritt, district superintendent, Skelly Oil Co., Shreveport; L. H. Moore, Gulf Oil Corp.



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15,000-Ft.-Plus Drilling

(Continued from page 153)

drives are rated at 850 hp. to handle the largest available mud pumps. All shafts and sprockets are mounted on roller bearings. Drives are provided for two air compressors and one generator which are mounted on top of the compound housing.

In the way of general specifications, all jaw clutch drives are inside the transmission case. All friction clutches are located on the outside of the compound for service accessibility. The rotary drive chain is 1½-in. pitch double and the cathead drive is 2-in. pitch double. The two oil pumps for the pressure-lubrication system are independently driven for safety. A feature of the rig is the oil-tight flexible guard covering the chains between the draw works and the compound. The flexibility makes it possible to rig up even though the compound skids may not be on the same ground level as the draw-works skid.

A wide number of power combinations are possible with the N-12 rig. The three most common combinations are expected to be: (1) All four engines driving the draw works. (2) Engine No. 1 driving the rotary, engine No. 2 driving the No. 1 pump, and engines Nos. 3 and 4 driving the No. 2 pump. (3) Engine No. 1 driving the rotary, engines Nos. 2 and 3 driving pump No. 1, and engine No. 4 driving pump No. 2. In the event any one of the four engines is down, one of the remaining engines can drive the rotary, one the No. 1 pump, and the other the No. 2 pump.

Draw-works specifications for the N-12 include the following:

Draw-Works Rating:
1,200 hp.—12,000 ft. plus.

Drum Shaft:
10-in. diameter maximum — S.A.E. 4140 alloy steel.

Brakes:
10-in. by 54-in. diameter — water cooled—325° wrap.

Drum Core:
28-in. diameter by 42 in. long.

Low Drum Clutch:
Twin-Disc PH-2-42-in. with lock out.

Low Drum Chain:
2-in. pitch triple chain.

High Drum Clutch:
Twin-Disc PH-3-30.

High Drum Chain:
2-in. pitch triple.

Drum Shaft Bearings:
S.K.F. 22244—8 11/16 in. i.d., 270,000 lb. static capacity.

Drum Speeds:
Eight speeds forward, two reverse.

Draw-Works Shell:
Made of 1¼-in.-thick plate.

Rotary Drive Clutches:
Two Twin-Disc PH 2 24 in.

Rotary Speeds:
Eight speeds forward, two reverse.

Cathead-Shaft Bearings:
S.K.F. 22232—6 5/16 in. i.d.

Cathead Speeds:
Speeds forward 98.5 to 304.2 r.p.m.

Equipment used in assembling the N-12 includes the following:

Standco brake linings.
Foster catheads.
Aeroquip air hoses.
Stewart-Warner electric tachometers and gages.
Martin-Decker weight indicator.
Hyatt bearings.
Timken bearings.
Parkersburg 46-in. hydramatic brake.
General Electric thyrite generator.
Buda PCS 2505, gas, supercharged, eight-cylinder engines with a nominal horsepower rating of 400.
Gerotor oil pumps.
Mission washdown pump.
S.K.F. bearings.
Fawick clutches.
Link-Belt chain.
Westinghouse air control equipment and compressors.

Equipping your rigs with Foster Catheads really is a "natural" for assuring long life and low maintenance for your catheads.
Foster Catheads have earned their place on the finest drilling rigs in the world thru years of specialization in cathead manufacture. This specialization has meant the best in safety, speed, dependability and economy, whether it is on catheads for the shallowest or the deepest wells.

FOSTER
AIR SPINNING CATHEAD

Safer . . . fully enclosed . . . operator can apply any desired amount of power to the pull line.
Faster . . . instant engagement without reducing lineshaft speed.
Dependable . . . 19½" single plate crawl-free friction clutch; recommended for pull up to 12,000 lbs.
Economical . . . smoothness of power makes spinning rope and spinning chain last much longer . . . no adjustments during life of Cathead.

FOSTER
AIR MASTER BREAKOUT CATHEAD

Safer . . . fully enclosed . . . operator in complete control of pull on jerkline at all times.
Faster . . . instant engagement without reducing lineshaft speed.
Dependable . . . 16" triple plate crawl-free friction clutch; amply powered and field proved.
Economical . . . no brakes required and no metal-to-metal impacts . . . no adjustments during life of Cathead.

In addition to the above the Foster Cathead Company manufactures the regular Foster Master, Type B, Breakout Cathead and Foster Spinning Cathead; plus the Foster Midget Master Breakout Cathead and Foster Midget Spinning Catheads for shallow drilling and cleanout rigs.

Foster CATHEAD COMPANY
P. O. BOX 1675 WICHITA FALLS, TEXAS

Conditioning Water for Secondary Oil Recovery in Appalachian Fields

by J. N. Breston*

PRIMARY objective in treating water for flooding purposes is to maintain the highest rate of water injection with a minimum of effort, by preventing any unintentional plugging of the sand at the input well or within the formation itself. Anything that interferes with the free entry of water into the sand seriously reduces the efficiency of the oil recovery operation[1 11] and increases the energy requirements and cost.

A second objective is prevention of corrosion of the water-handling system—not only to prevent what might become a heavy maintenance expense, but also because some products of corrosion are in themselves or after reaction with other constituents of the water a cause of plugging of the sand, thus, interfering with the attainment of the primary objectives.

A third objective that we know very little of so far, but which may become the most important of all, is to condition the water so that it is most effective in removing the remaining oil in the sand. In a sense this would make the water more "efficient" for its purpose. Attempts to increase oil recovery by such methods have been made in the laboratory and in small-scale field experiments, but with little practical results. However, it may soon develop as one of the next new techniques in water flooding.

Requirements for Ideal Water

So little is known about the behavior of water within the reservoir that it is only possible to postulate that the ideal water is that which enters and passes through the sand most freely. There may be other qualities which affect the quantity of oil removed, but they cannot be defined at present. The passage of the water through the sand with a minimum consumption of energy is a prime economic requirement. (Anything that interferes with the free entry of the water into the sand seriously reduces the efficiency of the operation. The more freely the water enters the sand body, the less power required to maintain the desired intake rate.)

No general rules for chemical constitution and physical properties of a water can be given, but the foregoing considerations point to a few fairly obvious requirements.

The water should be **free of any suspended matter** such as sand, mud, clay, and organic material including microscopic organisms such as algae, bacteria, molds, and slime. The complete absence of suspended matter is not only required in the vicinity of the water plant or at the filter but especially at the well head; or more correctly, at the entrance of the water into the sand body. Since the average pore diameter of the oil sands such as are found in Bradford and Allegany fields is but a few microns[9] it is absolutely necessary to keep the water free of fine-grained suspended matter, but this is important almost anywhere.

Chemical stability is the second important requisite for flood water. It is, for practical purposes, impossible to obtain a perfectly stable water. Dissolved gases such as oxygen, carbon dioxide, and hydrogen sulfide all cause instability. Because of the highly corrosive properties of dissolved oxygen alone, especially in brine and acid waters, it is the prime offender against stability and must be kept out of the water or removed, if it is normally in solution. Acid corrosion due to carbon dioxide or hydrogen sulfide causes the formation of insoluble precipitates, especially in the presence of oxygen. In fact, some evidence is being accumulated to show that these acidic constituents are relatively harmless if the water is free of oxygen, particularly hydrogen sulfide.

Most of the commonly applied methods of water treatment attempt to keep the alkalinity and pH of the water in a range where it is in a condition to deposit a calcium carbonate or complex phosphate scale on the inside surface of the pipe to prevent corrosion. However, if such treatment is not practiced with care there is the danger of precipitating material in the water and on the sand, or even within the pores of the sand body.[1 9 15 19] The use of complex phosphates minimizes this possibility but some risk remains. Thus, for the purpose of flooding, some operators prefer to keep their water free from deposit-forming substances, even if a certain amount of pipe may gradually be corroded.[22] They believe that as long as the products of corrosion are kept in solution it is preferable to submit to a slow internal corrosion than risk lowering the efficiency of an intake well by material precipitated from the water. Such acid corrosion can be greatly reduced by the use of soluble organic inhibitors and an absolutely oxygen-free environment.

Chemical stability must be required from numerous other ions present in waters.[11] Too high a content of iron and manganese increases the risk of their precipitation and should be reduced. Similarly, calcium and magnesium could cause plugging if supersaturation is produced by a change in the pH, temperature, or carbon dioxide content of the water. It is recognized that the exclusion of possible plugging materials such as sulfates and barium is often desirable[1 13] but is not practiced. The risk of precipitate formation by such ions is increased when flooding with brines from a source other than the oil sand.

Chemical instability of the water can be occasioned by growth of microorganisms[3 4 18] which produce hydrogen sulfide, carbon dioxide and other reduced metallic radicals. Such microbiological action initiates or accelerates corrosion and causes the precipitation of insoluble materials. Thus, one of the prime requirements for chemical stability is the minimization of microbiological growth.

As pointed out before, a limited knowledge of the mechanism of the movement of the fluids through the sand exists, and therefore it is not certain what the requirements of the water are after entering the sand. It can be definitely stated that the injected water must not react with the brines present in the oil sand with the formation of solid precipitates. This becomes especially important in areas where natural brines are used for flooding purposes.

It is known that a flood water which contains sulfate coming in contact with a brine which contains barium will form an insoluble precipitate of barium sulfate. In the same manner a water which swells the bentonitic materials of the clay in the sand pores will cause a reduction in the liquid conductivity of the sand, and is therefore harmful[1].

Water Treatment

The ideal properties of a flood water have been considered, and apparently many of the natural

*Laboratory director, Pennsylvania Grade Crude Oil Association, Bradford, Pa. Summary report of paper given at American Chemical Society symposium on "Conditioning Water for Repressuring Oil Fields and for Underground Disposal," Houston.

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waters in the northern Appalachian area are so near this ideal that good results are possible by using them in a raw state or with a minimum of treatment[15]. This is particularly so if strict attention is paid to the exclusion of dissolved oxygen and control of microbiological growths. However, the ordinary practices in the procurement and handling of the water are such that its chemical stability is easily upset, with the consequences of corrosion and the formation of insoluble materials which render the water unfit for flooding. Rather than take this risk, the general practice in water treatment has been to remove as much as is deemed necessary of those constituents of the water which would be the offenders if such chemical instability is occasioned by loss of carbon dioxide or contamination by oxygen. As a result, such treatment usually involves:

1. Treatment with lime or caustic and chlorine for elimination of manganese, iron, and hydrogen sulfide. Chemical stability (pH control) is obtained at the same time or adjusted after filtration with hydrochloric acid.

2. Settling in tanks or storage basins for precipitation of suspended material. Flocculating chemicals are often used to settle out precipitates and aid in filtration.

3. Filtration through gravity or pressure filters utilizing sand, anthracite coal, or diatomaceous earth as filter medium.

4. Treatment with complex phosphates as sequestering agent to prevent subsequent precipitation of iron and calcium.

5. Chlorine, copper sulfate, and other chemicals are used for control of algae, fungi, and bacterial growth.

As a result of such treatment a reasonably stable water is obtained having a slight scale-forming tendency which minimizes corrosion.

More recently with the development of amine-type corrosion inhibitors and bactericides[6,7,13], conventional fresh-water treatment is being compromised by some producers in favor of a slightly corrosive water with strict exclusion of dissolved oxygen. Such treatment is being used with the idea that as long as the water is in a reduced state and the products of corrosion are kept in solution it is preferable to submit to slow internal corrosion rather than risk the precipitation of material from slightly scale-forming water. In addition to this reason such treatment is finding favor since it involves only a slight chemical for control of bacteria and corrosion, and the resulting cost of treatment is lower.

Amine-type treatment will be reviewed after discussing the standard treatment operations:

Aeration

Until recently aeration was the most common method used to oxidize iron and manganese in the raw water so that they could be filtered out as solid oxidation products. Since at least 6 hours are required for complete precipitation, large water-storage facilities were necessary. With the use of chemicals and special precipitation equipment the time for settling can be cut to 1½ hours.

Aeration was also used to remove carbon dioxide and hydrogen sulfide. However, aeration is not subject to close control and it introduces oxygen into the water which makes it more corrosive. As a result aeration is no longer a standard practice.

Chemical Treatment

The adjustment of pH and alkalinity is made by the addition to the raw water of one of the commercial alkalies: lime, $Ca(OH)_2$, or caustic soda, NaOH. Lime is the cheaper of the two and in some instances the more desirable. It requires a special type of mechanical feeder, and since it is only slightly water soluble, must be fed dry or in the form of a suspension.

Caustic soda, NaOH, is more expensive than lime but has the advantage of complete solubility and requires no complicated mixer or feeder. Whether lime or caustic soda is used in any particular case is determined by consideration of all the factors involved.

Where oxidation is necessary for more complete removal of iron and manganese, chlorine is used along with lime or caustic soda[11]. Hydrogen sulfide removal is also accomplished very effectively by oxidation with chlorine. This treatment has proved itself satisfactory in service, and the increased cost of chemicals is more than offset by the saving in capital outlay for an aerator, pumping costs, and detailed supervision.

The chlorine is used either as gas fed from cylinders of liquid chlorine or in solution form as sodium or calcium hypochlorite. The latter is more suitable for smaller installations.

Complex phosphates, which include several different chemicals marketed under various trade names, are used to stabilize the water by preventing a delayed precipitation of calcium through a sequestering action. In many instances it is claimed that they are also effective in preventing corrosion by depositing a very thin protective coating on the pipe. Although this type of corrosion protection with the complex phosphates is supposed to be most effective at lower pH values it is still claimed to be obtainable in practical amounts at pH values as high as 8.5.

Treatment with sodium sulfite is occasionally employed to remove any dissolved oxygen from the water. It is quite effective but somewhat expensive when large quantities of dissolved oxygen are involved. Its use often necessitates additional settling time and filtration.

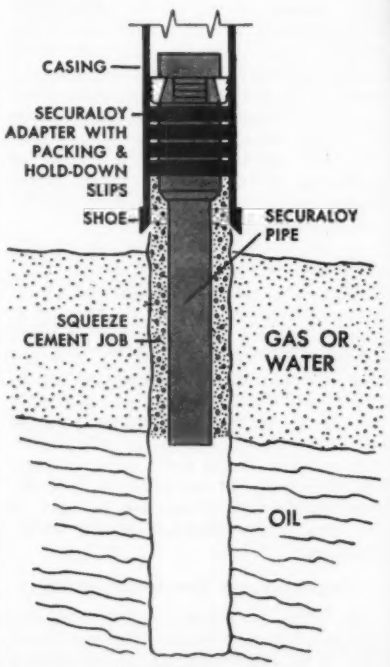
Coagulants and flocculating agents such as alum are sometimes used to speed up the settling of precipitates

USE OF SECURALOY SOLVES MANY PRODUCTION PROBLEMS

Securaloy pipe, which may be removed with chemicals or a drilling bit, is being used to solve many "difficult" production problems, such as correcting gas-oil ratios, water shutoffs and plug backs.

CORRECTING GAS-OIL RATIOS

This method is similar to that used in the case history shown on the opposite page except that the Securaloy pipe extends through the gas zone to the top of the oil zone.



Securaloy set on top of producing zone

This method is used where the entire oil zone can be produced from open hole and where it is not necessary to confine the oil production to selective strata. The hole through the oil zone is first filled with gravel. Securaloy pipe is run and squeeze cemented in position. When the cement has set, Securaloy cementing shoe and gravel are cleaned out and well is ready for production, with gas or water successfully under control.

SECURITY ENGINEERING CO., INC.

ONE OF THE DRESSER INDUSTRIES
Main Office and Plant: **Whittier, California**
Branches in all of the major producing areas
Export Office: **Chanin Building, New York City**

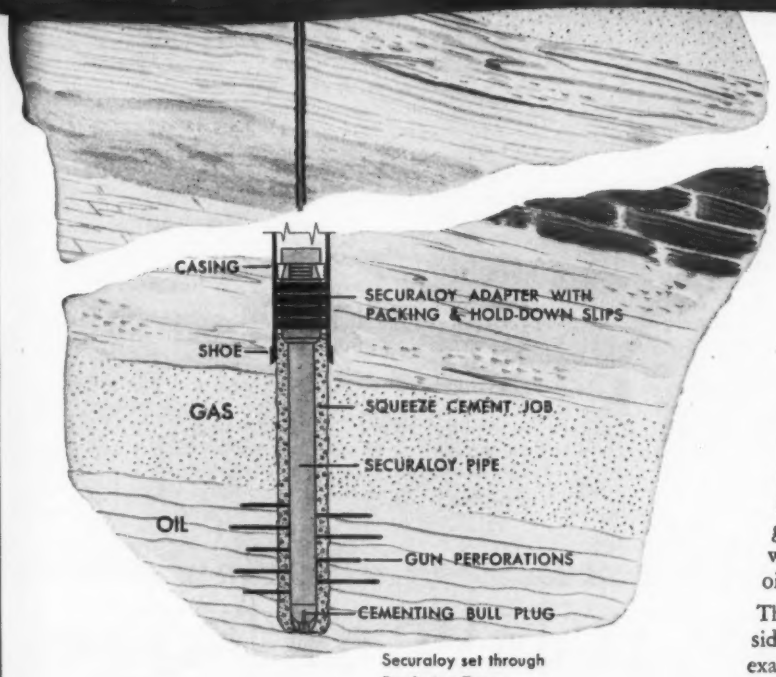
LOCATION: Texas

GAS-OIL RATIO: 300 to 1

PRODUCTION: 5-6 barrels per day on pump

QUESTION: How to increase production and lower gas-oil ratio by a simple and satisfactory remedial method

Too much gas—Too little oil?



Securaloy set through Producing Zone

When a Texas operator found his gas-oil ratio too high and production way down he determined that the positive way to correct this situation was to use Securaloy. You, too, can profit by using Securaloy to solve your gas-oil ratio problems.

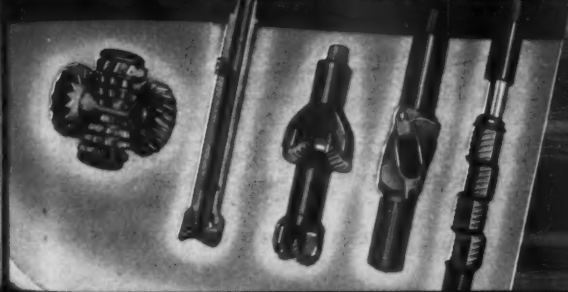
This operator first tried a plastic squeeze job, but the well still made only 6 barrels per day. Then a cement squeeze job was performed, with the entire open hole left full of cement and then drilled out. This proved unsuccessful too!

Finally, the operator cemented Securaloy pipe through the gas-oil sands, as shown. Selective strata were gun perforated and acidized. The well was then completed for 80 barrels of oil per day with a 40 to 1 gas-oil ratio!

This same remedial method is now considered standard practice . . . Another example of the application of Securaloy to solve your production problems.

Security

ROCK BITS • CORING BITS • HOLE OPENERS • REAMERS • CASING SCRAPERS



Securaloy

PRODUCTION EQUIPMENT

SECURITY ENGINEERING CO., INC.

ONE OF THE DRESSER INDUSTRIES

Main Office and Plant: Whittier, California

Branches in all of the major producing areas

Export Office: Chanin Building, New York City

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and improve the efficiency of the filters.

In cases where the pH of the filtered water is too high and there is danger from delayed precipitation of calcium carbonate[10], hydrochloric acid is employed to adjust the pH downward.

The use of chemicals to treat the water for control of organic growths is discussed under the heading "Control of Algae and Bacteria Growths."

Settling

If the raw water contains appreciable amounts of sand, silt, and clays, presettling for a sufficient time in raw-water-storage reservoirs must be allowed. Also, when chemical treatment is involved which precipitates solid material from the water, such as lime or caustic addition, about 4 hours of settling time[10] is allowed before filtering. It is also necessary when aeration is employed to oxidize iron and manganese. With sodium sulfite addition to remove dissolved oxygen settling time of several hours is allowed before filtering.

In the newer installations special chemical mixing and flocculating basins are used which greatly cut down on settling time and storage requirements.

Standard practice provides adequate provisions for frequent cleaning out of settling tanks and basins.

The time of settling is somewhat reduced and the efficiency of the filters improved by the use of flocculating agents such as alum and anhydrous ferric chloride.

Filtering

Of the various operations used to improve the quality of flood water, filtering is about the most important and is almost always part of the treatment no matter what else is done.

Three types of filters are commonly employed in the Appalachian area: gravity filters, conventional pressure filters, and diatomaceous-earth pressure filters.

Gravity filters are generally superior in filtration qualities and at one time were most commonly used, but they have lost favor in this area since their use makes it difficult to keep the water free of dissolved oxygen. Also, since the settling tanks are usually quite high and the filters must be the same height, they are very bulky to enclose for protection against freezeup. However, the simplicity of gravity-filter construction is a point in their favor.

Conventional pressure filters are those most commonly used since they operate at all times under air-free conditions, and their height is such as to make them convenient for installation inside the ordinary pressure plant.

Both the gravity and conventional pressure filters are packed with either gravel and sand or anthracite coal. Charcoal, coke, and manganese zeolites have been used but are very uncommon. Anthracite-coal packing is very much preferred since it backwashes fairly readily with less water even if the water contains some oil[10]; whereas sand and gravel must be discarded if contaminated with oil unless it can be cleaned with hot caustic solution. Occasionally alum is added to assist in the formation of the filter cake on the top of the filter, preferably only for a brief time after each backwashing. A helpful device in washing filters is the surface washer which is operated immediately prior to the time that the filter is being backwashed. Its use prevents "mud balls" and reduces backwash water requirements.

Diatomaceous-earth pressure filters are becoming more common for filtering flood water. They operate under pressure so that air is excluded and provide a very clear water. This type of filter does not require a large amount of backwash water since the old filter cake is removed by momentarily reversing the flow of water. Filtering is resumed after building up a layer of filter medium on the retaining elements.

Algae and Bacteria Growths

Bacteria, algae, molds, and other microorganisms are present to some extent in most raw waters or picked up on the way into or through the treating plant. Unless they are removed or their growth checked they will soon plug a filter or be carried down to the well where they will rapidly reduce the water-intake rate. Experience has proved chlorine to be effective in most cases in killing these microorganisms[4, 11]. Chlorine gas is injected continuously into the water in small amounts at the beginning of water treatment and, where necessary, after filtration to build up a satisfactory residual. In most cases an effective residual can be maintained through the water-distribution system to the wells without having to resort to concentrations which would make the water corrosive.

Hypochlorites, available under several trade names, are also effective in treating for control of these microorganisms. They are added to the raw-water tank once or twice a day, are easy to handle without special equipment, and are inexpensive. They are particularly useful in intermittent treatment or in clearing up a temporary contamination. The use of hypochlorite for cleaning out and sterilizing a water-flood system has been described in the literature[3].

Copper sulfate is also used rather widely and fortunately is effective for certain microorganisms which chlorine and its compounds do not kill very readily[10]. A small quantity of crystals is suspended once a day in the raw-water tank and allowed to dissolve and disperse.

Phenol derivatives, chloramines, and quarternary ammonium compounds are also used to control the growth of microorganisms. Since flood water is often used for domestic purposes by lease workers and their families, the use of the more poisonous bactericides such as organic mercurials has been avoided.

Deaeration and Deactivation

By using deep-well centrifugal pumps the dissolved oxygen-free character of the well water may be maintained to the treating plant and elimination of air entrainment during the treatment and subsequent handling of the water will continue this condition to the water intake well itself.

Where raw waters are not oxygen free at the source, vacuum deaeration and/or deactivation with sodium sulfite or sodium nitrite is employed.

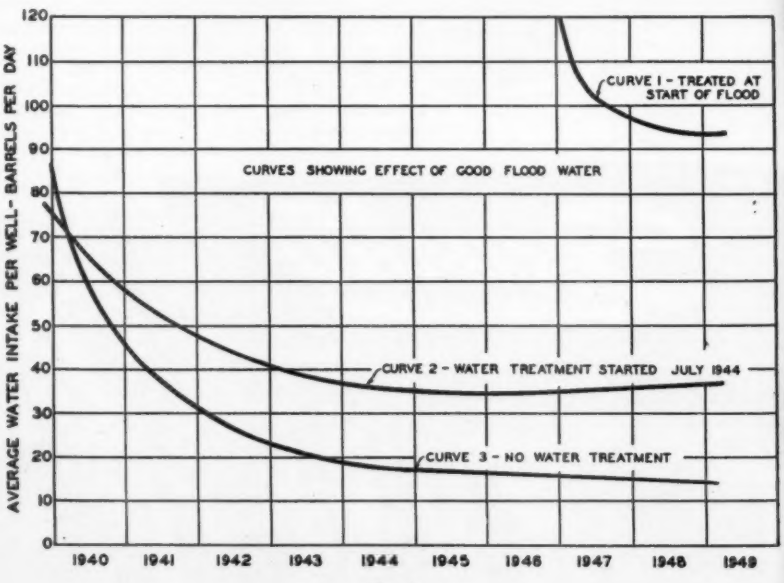

Fig. 1

These *INDIVIDUAL* "Rolling Dogs"

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Vacuum deaeration is effective down to a fraction of a part per million of dissolved oxygen[20, 21]. Elimination of the remainder is accomplished by deactivation with sodium sulfite or nitrite. Both are effective and relatively cheap, but the former is preferred because of the tendency of the latter to encourage the growth of microorganisms by the introduction of nitrogen.

Vacuum deaeration is practiced on a very limited scale but deactivation with sulfite is rather common.

Treatment of Brines

In a few cases dilute brines provide the only conveniently accessible supply of flood water. Such brines occur naturally or may be fresh waters which have been contaminated by produced water[22]. In other limited areas where disposal of produced water is a problem it is utilized for flooding, with fresh water being used for makeup[5].

The treatment of natural dilute brines mostly follows the conventional methods with strict attention to the exclusion of dissolved oxygen and a delicate control of the before-and-after treatment with complex phosphate.

Mixtures of produced water and fresh water present a more difficult problem in treatment. Where such brines are used for flooding, the fresh water, obtained from rivers or wells, is not treated separately but dumped into the same settling pit with the produced water. After settling for a sufficient time for oil removal, the mixture is treated with lime, chlorine, and coagulant and sent to settling tanks for thorough precipitation of solids.

As the water enters the filters it is treated with phenol derivatives and complex phosphate. Such treatment has been found to be effective in preventing the filters from becoming fouled and makes them easier to backwash.

Anthracite coal is usually used for filter medium since it does not "poison" with oil as readily as in the case of sand and gravel. In most instances an additional treatment with complex phosphate is applied to prevent delayed precipitation in the filtered water.

Fortunately, the blanket of oil and other organic material on the water in the settling pits takes care of the dissolved oxygen so that little if any auxiliary treatment for oxygen is necessary.

Results

Water treatment by the procedures just described have been practiced in the Appalachian fields with increasing effectiveness over a period of some 20 years. The over-all results are manifest in the ever-increasing yield of oil per acre, especially from the sands with low permeabilities which are difficult for water to permeate. Ultimate yields, even though greater, have been obtained in shorter periods of time and with less water and at less cost.

The effect of good water treatment on the intake rate of wells has been variously described[1, 9, 11, 15, 16] and is specifically illustrated in Fig. 1. Curve 1 shows the average intake rates in a flood where the water was treated from the very start. Following the fillup period there is little or no decline to be noted. Curve 2 shows the intake rates in a flood where conditioning was not started until 4 years after the start of the flood. It may be noted that not only was the decline stopped but a gradual increase in intake developed. Curve 3 shows the average intake rates in a flood where there was no chemical treatment.

Cost of Conventional Treatment

The cost of treating water for flooding will vary depending on the degree of treatment applied and the quantity of water handled. In general, costs will average from 0.1 to 0.2 cents per barrel for fresh-water treatment and 0.1 to 0.3 cents per barrel for treating brines. The investment in equipment will vary from $1 to $2 per barrel capacity for a 10,000 to 20,000-bbl. per day plant.

Good water treatment is easily justified when one considers the obvious benefits in decreased operating costs and increased oil recovery. Besides helping to maintain the highest rate of recovery and largest ultimate yield of oil, proper water treatment cuts operating costs by minimizing leak trouble and replacement of surface lines and well tubing.

Amine Treatment for Bacteria and Corrosion Control

Theory and development.—As was mentioned previously, water treatment in the Appalachian area is being compromised by some producers in favor of a slightly corrosive water with strict exclusion of dissolved oxygen. Such treatment is being used with the thought that as long as the water is in a reduced state and the products of corrosion are kept in solution, it is preferable to submit to slow internal corrosion rather than risk the precipitation of material from a scale-forming water.

To control excessive acid corrosion and growth of microbiological organisms, treatment with certain amine-type chemicals has been developed by the Pennsylvania Grade Crude Oil Association laboratory[5, 6] and tested in the field by Quaker State Oil Refining Corp.[7, 14]. The chemicals used for such treatment belong to the broad classification of alkyl and aryl high-molecular-weight amines and amine salts, and certain ethylene oxide-amine condensation products. They are relatively nontoxic water-soluble chemicals readily available on the market.

These chemicals, besides being very potent bactericides, are also cationic surface active so that they are readily absorbed onto metal surfaces. Adsorbed films of such compounds greatly reduce the rate of corrosion of pipe conducting corrosive waters. Except for filtration, no other chemical or physical treatment is applied to the water.

Surprisingly enough, these compounds are effective bactericides and corrosion inhibitors when used in concentrations of only a few parts per million. Although recommended generally for air-free water, they have proved to be effective even in the presence of 1 to 2 p.p.m. of dissolved oxygen. Certain of these compounds are compatible with oil-field brines and show promise of being applicable to the treatment of such waters if they are air free. As bactericides they are still very effective even in the presence of considerable quantities of dissolved oxygen.

Although laboratory tests[6] have shown that a considerable number of amine-type chemicals could be effective for such water treatment, the bulk of the field experience has been obtained with but a few; namely, Rosin Amine D Acetate,* Pur-O-San,† Arquad S and 2C.‡ Rosin Amine D Acetate which was the first one tried in the field[7] has proved itself so applicable that it is being used on at least 25 leases of some of the major producers in Bradford field. Pur-O-San has been used less widely in this area. Since it is compatible with brines, it is being tested in areas where produced waters are used for flooding. The Arquads are still in the stage of small-scale field tests.

Treatment.—Treatment with amine-type chemicals is very simple and involves only the injection of the proper amount of a solution of the chemical into the water at some point before the filter or high-pressure pumps[17]. Most generally the chemical is injected into the water coming into the raw-water tanks or, if there is no raw-water storage, just before it enters the filter. In some instances the chemical is fed into the supply well in order to protect the pipe between the well and the pressure plant. This type of installation although ideal involves some method of overcoming weather limitations since such locations have little or no shelter. The chemical is handled with a low-pressure chemical feeder having some control of the feed rate.

Experience with this type of water treatment has shown that better and faster results can be obtained in clearing up a bad water if the water system on the whole lease is cleaned up by slug feeding of hypochlorite solution [2, 17] for a short period of time prior to feeding the amine. At the start of the amine treatment it has been found beneficial to start with a concentration of 25 to 40 p.p.m. and

*Hercules Powder Co., Wilmington, Del.
†Pur-O-San Co., Bradford, Pa.
‡Armour & Co., Chicago.

then cut this down when tests[25] show that a residual of amine is being maintained to the farthest ends of the water-input system.

As would be expected from the behavior of film-forming chemicals, after a good film has been deposited on the metal, the residual concentration of the chemical in solution can be greatly reduced with the film still remaining intact and effective. No delicate control of the residual concentration is necessary, and, in fact, the chemical feed can be temporarily halted for hours or days without causing the water to become turbid. Such latitude is not possible with scale-forming waters—they will become turbid almost immediately upon interruption of chemical feed.

For purposes of control and following the progress of amine-type water treatment, several procedures have been used:

For direct measurement of the progress of the treatment, turbidity measurements and bacteria counts are made on samples taken periodically at key locations in the system and on backflow samples for intake wells. Direct measurement of corrosion control is difficult to assay from iron pickup analysis, and so it is determined indirectly from the rate of corrosion of test coupons inserted in the water lines according to the method described by Breston and Barton[7]. The use of test nipples, although more convenient, is a less reliable method of determining the degree of corrosion control, as is the incidence of leaks. The over-all effectiveness of amine-type water treatment is determined by the variation in the intake rate of the water wells.

Results

One producer in Bradford field* had a considerable number of leases which had no type of water treatment whatsoever and which were so close to the limit of economic production that it was considered impractical to invest in the conventional type of water treatment. However, it was felt that the simplicity and low cost of amine-type treatment might still accomplish some good even so late in the operation. Since 1947, amine-type treatment has been applied to the water on some 20 leases. The variation in the character of the waters included high and low dissolved oxygen, high hydrogen sulfide, high iron, and relatively high salt content and low pH—all of which had corrosive effects on the iron pipe. In addition most of the waters abounded in microbiological growths.

The results of 2 years of such treatment[14] using mainly Rosin Amine D Acetate but also Pur-O-San and Arquad S indicated the following:

1. All three materials gave satisfactory control of organic growth in most waters. An example of such results is illustrated in Fig. 2 showing the bacteria counts on one of the leases before and after treatment.

2. Effective corrosion control was obtained with Rosin Amine D Acetate and Pur-O-San, and to an undetermined degree with Arquad S. The results obtained with Rosin Amine D Acetate on water containing dissolved oxygen showed good protection though not as great as in oxygen-free water. Pur-O-San and Arquad S have not been tested as yet under the latter condition. Fig. 3 illustrates graphically the decrease in corrosion by a slightly acid flood water when using Rosin Amine D Acetate treatment.

3. A marked decrease in turbidity was obtained with all three inhibitors. The effect was noted most in waters that contained considerable hydrogen sulfide.

4. Where the feeding of amine was continued for an appreciable time, it was established that not only was there no further decrease in water intake rates, but there was a definite indication of a slight increase.

Other beneficial effect of amine treatment that were noted were elimination of slime in filters, reduction in the frequency of backwashing, reduction in the number of leaks in lines and tubing, and a definite indication of increases in oil producton due possibly to more continuous pressure application; i.e., fewer shutdown periods for leak repairs.

The experience with Pur-O-San[15] on a number of leases indicates that it is very effective in controlling microbiological growths, and, by coupon tests is a fairly good corrosion inhibitor. Fig. 4 illustrates the powerful bactericidal effect produced by Pur-O-San treatment of a particularly polluted lease water. Good control of bacteria growth was obtained with concentrations as low as 1 p.p.m. More recent tests with Pur-O-San in treating brines for flooding have not

*Quaker State Oil Refining Corp., Bradford, Pa.

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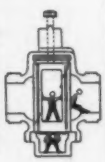

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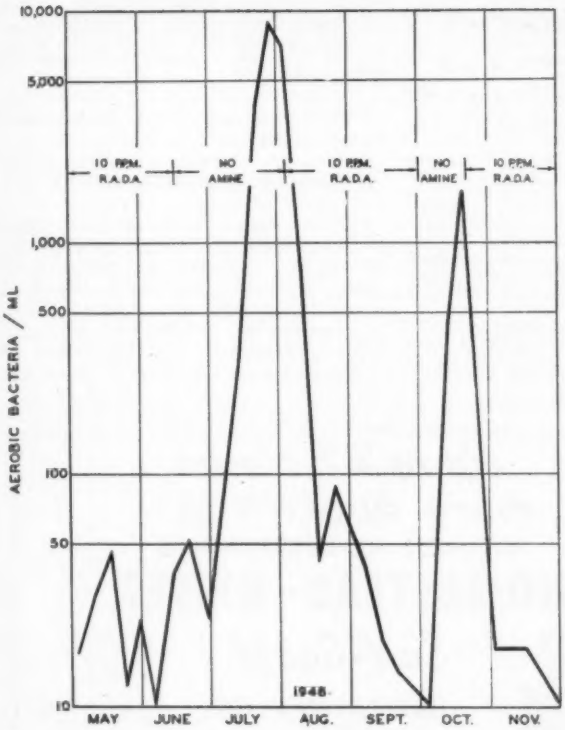

Fig. 2—Forty-eight-hour bacteria counts on back-flow water. Quaker State Fisher lease. Rosin amine D acetate treatment experiment.

progressed far enough to give positive results, but there are indications that such treatment will be effective.

Most recently a small but well-controlled field test[24] has shown that treatment with 10 p.p.m. of Arquad 2C is just about as effective as chlorine in eliminating all growth of bacteria in a fresh water containing up to 1.5 p.p.m. of dissolved oxygen. Corrosion-control data are not available as yet, but if expectations based on laboratory tests are realized, Arquad 2C will prove very effective.

Cost of Amine Treatment

The cost of chemical treatment with amine-type chemicals will range from 0.02 to 0.06 cents per barrel depending on the type of amine used and the concentration necessary to be effective. This cost is low compared with the 0.10 to 0.20 cents cost of chemical treatment by conventional methods.

Since nothing but a simple low-pressure chemical feeder pump and a pressure filter are necessary, the investment in the treating plant and equipment would be somewhat lower than the $1 per barrel capacity invested in a conventional treating plant. The main saving in investment is made in chemical-injection equipment and a reduction in precipitation and settling-tank capacity.

To the low cost of amine treatment may be added the reduced cost of treating-plant maintenance since the plant is smaller and has fewer items requiring attention, and reduced backwash-water requirements.

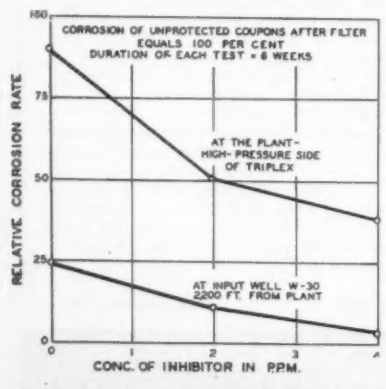

Fig. 3—Rosin-amine acetate inhibitor tests. Quaker State McManus lease.

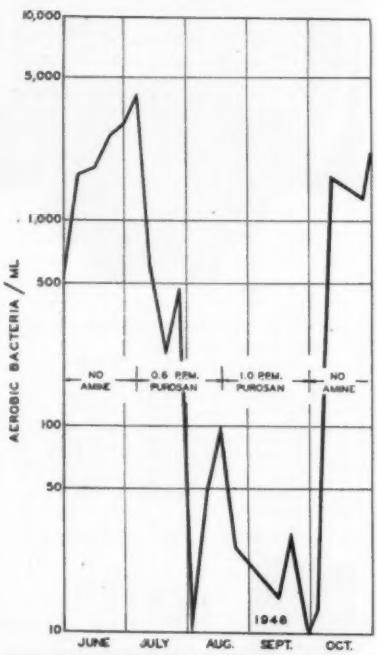

Fig. 4—Forty-eight-hour bacteria counts. Line water at Well O11. Quaker State Fisher lease. Purosan treatment experiment.

Of course one does not design a water-treating plant to save money by providing a water with a minimum of objectionable properties, but rather to provide the **best** flood water compatible with the aims and requirements set forth earlier in this paper. However, in certain of the water-flooding fields of the Appalachian area, and especially in Bradford field, as high as 50 to 100 bbl. of water are required to produce 1 bbl. of oil from some leases. Considering the price of crude today, it is easy to see that a reduction of 0.1 cent per barrel in treating costs may mean the difference between economic recovery and abandonment. For this reason considerable research effort is being spent on developing more economic and efficient water treating practices.

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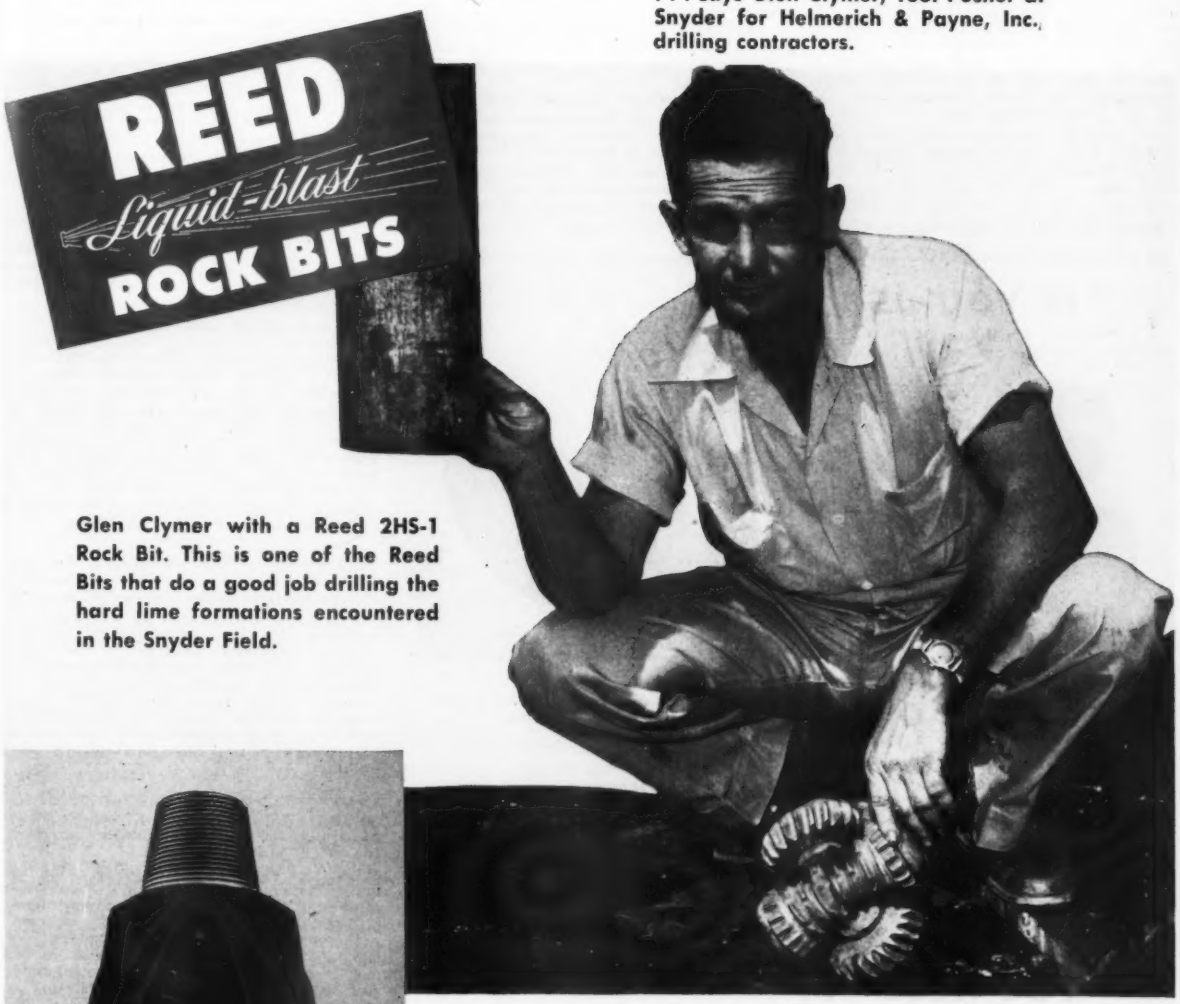

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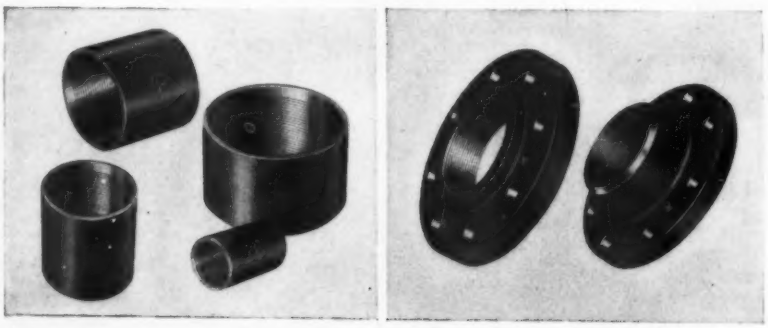

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BOOKS

CORRELATED INDEX OF NAMES FOR OIL AND GAS FIELDS IN OKLAHOMA. Available through J. D. Young Reproduction Co., 116 West Third Street, Tulsa. $20.

This crossindex lists names and descriptions of all Oklahoma oil and gas pools alphabetically and conversely the pools also are listed numerically by descriptions as to section, township, and range. O. C. Blade, of the U. S. Bureau of Mines in Bartlesville, Okla., directed compilation of this volume, need for which has been mentioned by oil scouts and company men. The volume, printed by the lithograph process, is loose leaf, and bound in imitation leather. Approval of the book has been voted by the Oklahoma Nomenclature Committee.

PLANNED CONTROL OF COSTS IN THE RESEARCH DIVISION OF AN OIL COMPANY. By H. L. McKinnon. Article included in N.A.C.E. Bulletin, published by National Association of Cost Accountants, 505 Park Avenue, New York.

In this article the author, with Shell Oil Co., at Houston, reviews the factors on which research factors are evaluated and the limits within which they are budgeted in an oil company in which exploration and production research endeavors have been committed to a division established since the war and now staffed with a personnel of 140. The author deals both with the significance of research to the company and with the detail of procedures through which research outlays are passed on and accounted for.

INDEX TO WELL SAMPLES. By Dan E. Feray and Jasper L. Starnes. Published by University of Texas, Austin. 147 pp. $1.65.

This book is an index to the extensive collection of well samples which the Bureau of Economic Geology of University of Texas has been accumulating since its establishment in 1909. The collection includes samples from nearly 30,000 wells from all parts of Texas, and the information is arranged alphabetically by counties, then by companies, then by fee owner and number.

INTRODUCTION TO THEORETICAL IGNEOUS PETROLOGY. By Ernest E. Wahlstrom. Published by John Wiley & Sons, Inc., New York. 365 pp. $6.

This volume is an attempt to bring together between the covers of a small book the basic facts and ideas of modern igneous petrology in a form that can be comprehended by the average student of geology. It is assumed that the reader has a working knowledge of petrography and at least an elementary training in physics, chemistry, and mathematics. Descriptions of actual field examples are held to a minimum, partly because their inclusion would greatly expand the text material and partly because of the author's desire to emphasize theoretical concepts.

ELEMENTS OF OIL RESERVOIR ENGINEERING. By Sylvain J. Pirson. Published by McGraw-Hill Book Co., 330 West 42nd Street, New York. 441 pp. $6.50.

This is a graduate-level text for petroleum engineers, which develops and coordinates the principles which govern the behavior of geological petroleum reservoirs when placed under protection during their primary phase and during the application of external sources of energy as practiced in secondary-recovery operations. The discussion develops the concepts of three fundamental production processes—water, segregation, and depletion drives, which may operate singly or in combination. Each oil-production mechanism is shown to have a particular recovery efficiency which may be determined from a knowledge of the reservoir fluids and rock characteristics. Recent advances in the methods of testing properties of reservoir rocks and reservoir fluids are covered. Up-to-date illustrative problems and production statistics are included to supplement study of the text.

QUESTIONS on TECHNOLOGY

by W. L. Nelson
Consulting Engineer

Distillations of Crude Oils or High-Boiling Components

How can we estimate the boiling points of high-boiling materials? Of course, we can conduct distillations but these are time-consuming and in design work we have no samples to test.—R. P. M.

The most widely known relationship is the "characterization factor" which was first introduced by Universal Oil Products Co. Although it has been related to many physical properties, the most common relationship involves specific gravity and the molal average boiling point in absolute degrees Fahrenheit, thus:

$$K = \frac{(°F. + 460)^{1/3}}{\text{Sp. gr. at } 60° F.}$$

However, the use of this constant presupposes that the "K" value is already known for the crude oil or stock under consideration. Values of "K" have been published for many oils (third edition of Petroleum Refinery Engineering, McGraw-Hill Book Co., 1949, pages 88-90, 146, 569, and 674), but there are seldom data for the particular stock that is at hand.

One means of avoiding the above difficulties is to relate the boiling point to some other more easily obtained property such as the gravity of the crude oil or even better, the percentage of gasoline and naphtha. Figs. 1 and 2 were developed from a study of over 110 true-boiling-point analyses. In Fig. 1, the part of the crude oil that boils up to 450° F. (a gasoline and naphtha) is plotted as 100 per cent, whereas in Fig. 2, the part of the crude oil that boils above 450° F. (the base material) is plotted as 100 per cent.

The approximate distillation curve of any crude oil can be estimated from Figs. 1 and 2 as shown in the example on this page.

Example.—An 18 A.P.I. naphthene-base crude oil contains 7½ per cent of 400 e.p. gasoline and naphtha. This means that the amount of material boiling up to 450° F. by a true-boiling-point distillation will be about 10 per cent.

From Fig. 1 and using the line for 10 per cent gasoline and naphtha, the following are read as the boiling points of the gasoline (based on itself and also based on crude oil):

Per cent in gasoline	Corresponding per cent of crude oil	T.B.P. (°F.)
10	1.0	210
20	2.0	256
50	5.0	355
80	8.0	425
100	10.0	450

The same type of tabulation is set up for the base or remaining portion using Fig. 2.

Per cent in base	Corresponding per cent of crude oil	T.B.P. (°F.)
0	$10 + (0 \times 90) = 10$	450
20	$10 + (0.2 \times 90) = 28$	660
40	$10 + (0.4 \times 90) = 46$	838
60	$10 + 54 = 64$	975
80	$10 + 72 = 82$	1,030

The relationship of crude-oil gravity to percentage of gasoline and naphtha was discussed on the Questions on Technology page of August 3, 1950.

Gasoline Volatility Changes Since 1920

How has the boiling range of gasoline changed over the years?—H. A. V.

Table 1, mainly from U. S. Bureau of Mines survey, shows the distillation properties and gravities of gasolines since 1920.

TABLE 1—PROPERTIES OF REGULAR GASOLINES

Date—	A.P.I. grav.	Boiling points, °F. I.b.p.	10%	20%	E.p.
July 1920	57.4	130	...	208	446
July 1921	57.9	125	...	202	433
July 1922	56.8	121	...	208	429
July 1923	56.9	125	...	206	436
July 1924	56.9	107	...	200	431
July 1925	56.2	108	...	204	427
July 1926	57.2	100	...	194	421
July 1927	57.7	102	...	193	417
Winter 1928	...	...	146	...	426
Winter 1930	...	...	...	...	420
Winter 1931	...	...	148	...	411
Winter 1934	...	...	135	...	403
Winter 1937	...	...	125	...	401
Winter 1939	...	...	127	...	396
Winter 1946	...	...	125	...	395
Winter 1948	62.1	91	126	154	396
Winter 1949	62.0	91	125	154	399

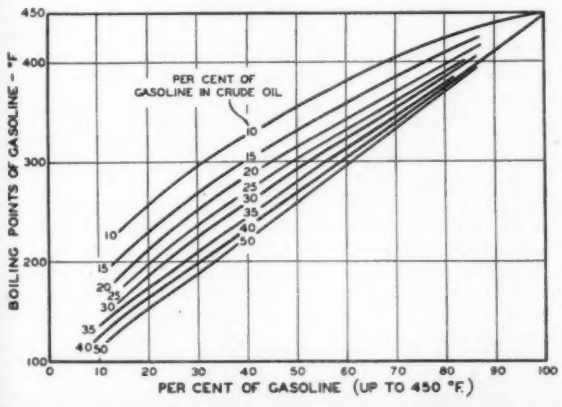


Fig. 1—True boiling points of the gasoline portion of crude oils plotted as 100 per cent.

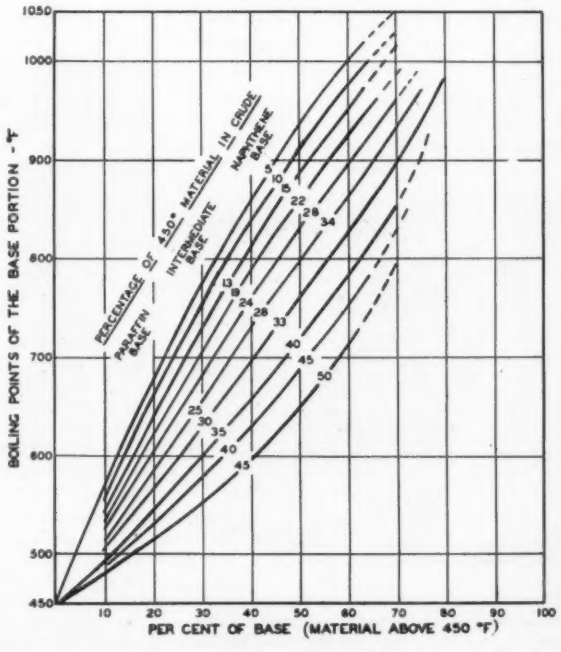

BOILING POINTS OF THE BASE PORTION - °F
PERCENTAGE OF 450° MATERIAL IN CRUDE
PARAFFIN BASE
INTERMEDIATE BASE
NAPHTHENE BASE
PER CENT OF BASE (MATERIAL ABOVE 450 °F.)

Fig. 2—True boiling points of the base portion (above 450° F.) of crude oils plotted as 100 per cent.

XUM

FAST DRILLING

Research pays off dramatically when Humble drills a record 2,448 ft. in one 8-hour tour

THE results of 6 years of drilling research were dramatically highlighted a month or so ago in Natchez, Miss., when a Humble Oil & Refining Co. rig drilled a record 2,448 ft. in one 8-hour tour.

The drilling report showed 15 minutes for running 720 ft. of drill pipe in the hole and 7 hours 45 minutes rotating time—an average penetration rate of 316 ft. per hour. It was necessary for the crew to make a new connection about every 5 minutes to make hole at this fast rate.

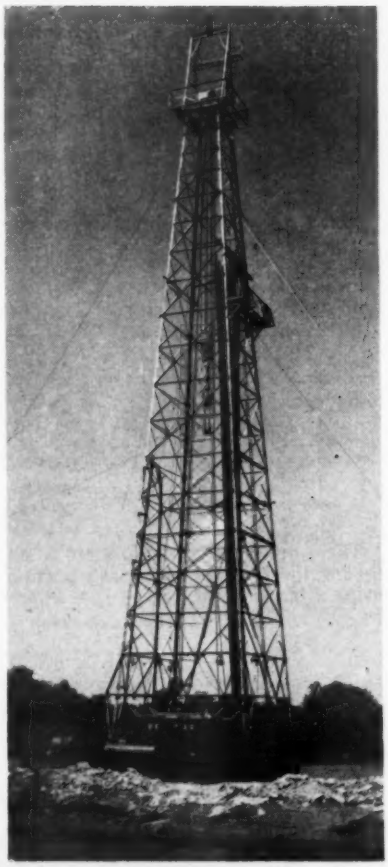
High penetration rates are not new to the men of Humble's Rig 28. In March, a crew drilled 2,014 ft. in a regular 8-hour tour, and in April this was surpassed by another crew which made 2,019 ft. in 8 hours. Then, the morning-tour crew of Rig 28 changed the drag bit which drilled at the record speed and drilled 1,100 ft. through limestone with a jet-type rock bit.

Since last November, the men of Rig 26 have drilled and completed 14 wells totaling 97,803 ft. They have reduced average time required to drill and complete a well in the area from 23 to 8 days. This has been done without sacrificing safety—Rig 28 holds the Louisiana division plaque for safe drilling.

The Natchez area where the rig is drilling is "easy diggin'" when contrasted to West Texas, but it is not the easiest drilling on the Gulf Coast. There are many places in the Gulf Coast area where there are thicker and more penetrable sections of shale and sand. Limestone is encountered at about 3,400 ft. in the Natchez area, and drag-type bits are replaced with rock bits when the lime is reached.

Humble's fast drilling is not restricted to the Natchez area. Rig 26, a barge rig in Lake Sand, southern Louisiana, has been drilling and completing 10,800-ft. wells in 18 days. This compares with a previous 47 to 53 days. In Jourdanton field, Southwest Texas, Rig 11 is drilling and completing 5,200-ft. wells in 7 days.

SAFETY RECORD PLAQUE.—Recognition for best operation in Humble's Louisiana division hangs over drillers' desk on Rig 28. Tool Pusher A. W. Cook stands by as Driller W. L. Nelson writes up his daily report.



RIG 28.—On location in the rolling hills of an antebellum plantation near Natchez, Miss., where the drilling record was set.

The use of jet-type bits is felt by Humble probably to be the most important single factor in the successful reduction of drilling time in these formations. However, these bits represent only one phase of the company's extensive drilling research program. This program began in Louisiana back in 1944.

To initiate the research, seven wells in a Louisiana field were drilled with slight changes in procedures. The report on these wells indicated a relationship between drilling speed and circulation rate. Consequently, a research project was set up in 1946 to study factors affecting Gulf Coast drilling rates.

Where wells were being drilled through sections of uniform hardness in the same field, comparisons were made to isolate the effects of different parts of the drilling process: circulating rate of the drilling mud, weight on the bit, speed of rotation, and the nozzle velocity of the mud passing through the bit. The tests were made in Red Fish Reef, Seeligson, Borregas, Danbury, and Sugar Valley fields in the Texas Gulf Coast area.

Short Sections Drilled

Where a thick uniform formation was encountered, short 30 to 60-ft. sections were drilled while maintaining constant all but one of the factors affecting the drilling rate. That one factor was then varied from minimum to maximum to determine its effect on the rate of penetration. For example, a section was drilled with 10,000 lb. on the bit, the next with 20,000 lb., and so on. At 40,000 lb. the drilling rate was the fastest, and at 50,000 lb. the speed dropped rapidly as the bit "balled up," rolling the chips from the bottom into a ball on the bottom of the bit and slowing drilling.

The effect of weight could not be considered known, however, until it was tested when the other factors were in proper relationship for fastest drilling. The whole undertaking took months, since the tests could be made only in a part of a well, and further tests had to wait until the next well was started.

As the tests progressed, several things began to appear significant. It was found that the drilling rate

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OTIS PRESSURE CONTROL, INC. — Service and Equipment

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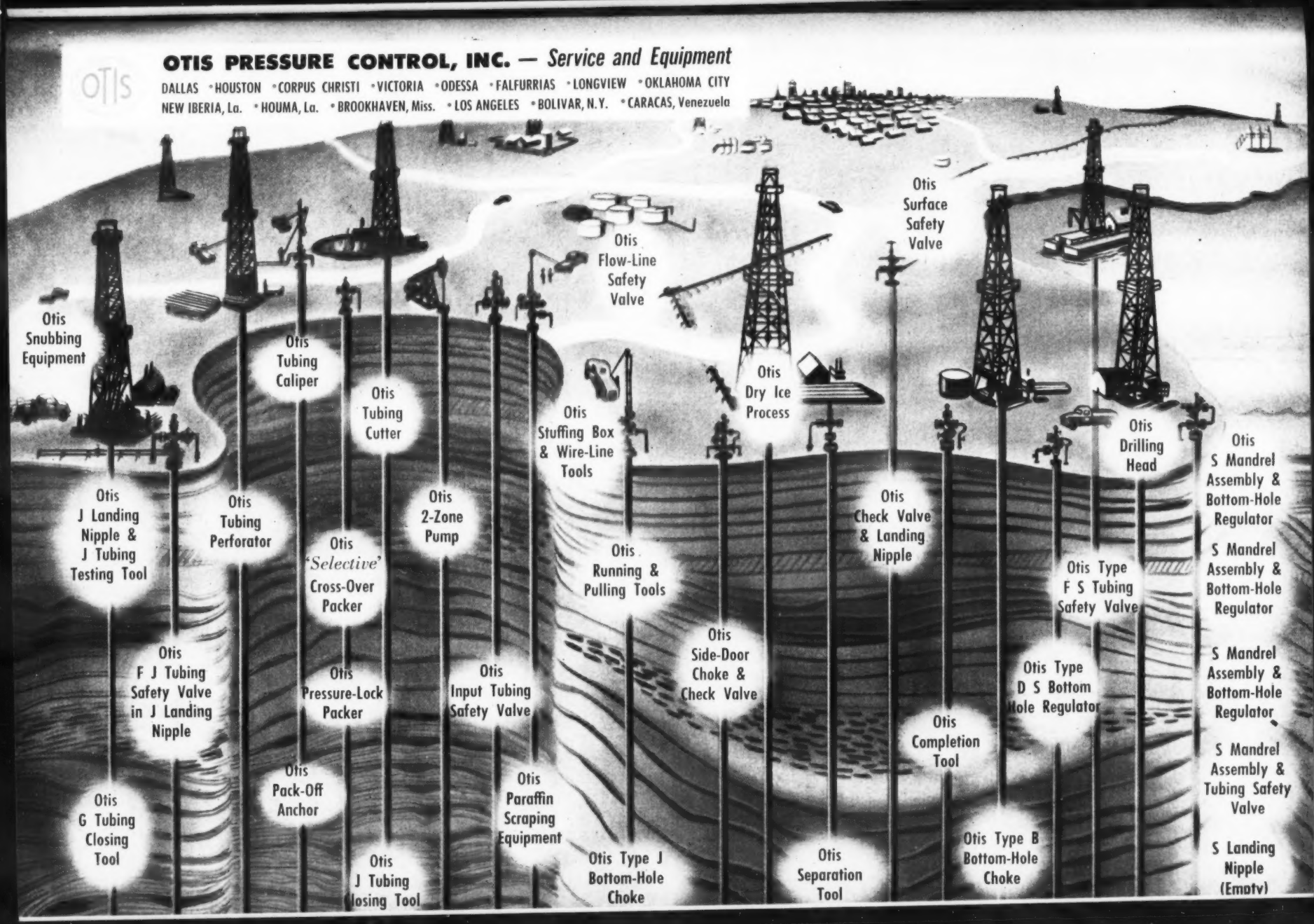
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Otis J Landing Nipple & J Tubing Testing Tool
Otis Tubing Perforator
Otis 2-Zone Pump
Otis 'Selective' Cross-Over Packer
Otis Running & Pulling Tools
Otis Check Valve & Landing Nipple
Otis Type F S Tubing Safety Valve
S Mandrel Assembly & Bottom-Hole Regulator
Otis F J Tubing Safety Valve in J Landing Nipple
Otis Pressure-Lock Packer
Otis Input Tubing Safety Valve
Otis Side-Door Choke & Check Valve
Otis Type D S Bottom Hole Regulator
S Mandrel Assembly & Bottom-Hole Regulator
Otis Completion Tool
Otis G Tubing Closing Tool
Otis Pack-Off Anchor
Otis Paraffin Scraping Equipment
S Mandrel Assembly & Tubing Safety Valve
Otis J Tubing Closing Tool
Otis Type J Bottom-Hole Choke
Otis Separation Tool
Otis Type B Bottom-Hole Choke
S Landing Nipple (Empty)

was proportional to the weight on the bit, the speed of rotation, the circulating rate, and the nozzle velocity of the fluid going through the bit. When the tests started, it had been thought that the main purpose of the drilling mud was to flush the cuttings from the hole; therefore, a high circulating rate would be best. The tests showed, however, that higher circulating rates did speed drilling, but more and larger mud pumps were required for deep drilling.

On the other hand, a high nozzle velocity at the bit gave a larger boost to the drilling rate, and no extra pumps or horsepower were required: simply use a bit with small watercourses, and gain the optimum relationship between the circulating rate and the nozzle velocity. Further tests determined the correct size nozzle for each size hole and each depth which gives enough speed to the mud returning to the surfaces that it will carry along the cuttings.

High nozzle velocities of 200 to 500 ft. per second wore bits out quickly, and attention was given to bit design to make them last longer. Bit manufacturers cooperated, and tungsten carbide nozzles—specially designed and able to withstand the abrasion of high mud velocities—were installed in the bits. The bit blades were straightened and faced with borium and tungsten carbide. These extremely hard metals reduced abrasion, and the changes in the blade and the direction of the nozzles had an even greater effect on the bit's digging characteristics.

Much More Weight Used

Tests made in clay and in wax revealed that a chip arches up in front of the bit blade as it digs. The high-velocity stream of mud was then directed to the top of the chip, and it was found that the force of the mud "jet" pulverized the chip on contact. The very small particles of the formation dug up and broken up were then swept upward quickly and easily in the mud stream. Bits of this type drilled as much as five times faster, and could carry up to 40,000 lb. weight without balling up and reducing the drilling rate.

As soon as the new-type bits were available they were sent to Humble rigs in the Gulf Coast area and reports of faster drilling began coming in as drillers combined proper use of mud pumps with the new bits. They began drilling with four times the usual weight on the bit. Twelve drill collars—the extra-heavy sections of drill pipe placed at the bottom for weight—360 ft. long and weighing 40,000 lb., were used.

The bits lasted longer and drilled faster. In 10,000-ft. wells in Sugar Valley field the number of bits to drill a well was reduced from 25 to 16, and actual drilling time was halved. One bit has drilled as much as 4,000 ft. Similar savings in drilling time and bits were made in all drag-bit areas.

EXPERIMENTAL JET-TYPE ROCK BIT (left).—Held by Derrickman M. W. Buckley; has already increased drilling rates 10 to 100 per cent in moderately hard formations. JET-TYPE DRAG BIT (right).—Developed for drilling relatively soft shale and sand of the Gulf Coast area, carried by J. C. Ducote. The blade peels up chip, which is pulverized by mud jetting. The nozzle is visible beside gloved hand.

Carrying so much weight on the bit caused some doubt, because every driller knows that too much weight on the bit will cause it to "wander" and deviate the hole from vertical. With jet bits, however, the deviation is no more than with conventional bits.

Reduced wear of equipment in another gain with jet-type bits. There is less wear on the drill pipe, since there are fewer revolutions per foot drilled, and there is less wear on all rig equipment, as everything operates at full capacity for a shorter time.

Because a worn-out jet-type bit drills about the same as a conventional bit, several means have been developed to indicate to the driller when the bit is dull and should be pulled. A dull-bit indicator has been adopted by bit manufacturers under license from Humble.

READY FOR ROUND TRIP.—These evening-tour crewmen of Rig 28 are G. J. Dore, W. E. Diamond, and R. C. Barbour, Jr.

The success of the research into the facts affecting drag bit drilling prompted Humble engineers to turn to rock bit drilling. This work began last year, and already drilling rates in medium hard formations have been increased from 10 to 100 per cent by applying the principles which apply to drag-bit drilling.

In Pickton field in Northeast Texas, Rig 17 has used jet-type rock bits and cut the time for drilling 7,000-ft. wells from 28 days to 13. This is for the actual rotating time in days, only. The actual over-all time to drill a well in the Pickton field prior to the use of jet type rock bits was about 53 days.

Studies in rock-bit design and the properties of the drilling mud have shown promise of further results. Already known is the fact that the chemical properties of the mud are important with rock bits. Different types of muds have varying effects on the drilling rate, and in some places, there has been a return to drilling with water down to certain depths. Water, incidentally, is an ideal fluid in some hard-rock drilling.

The experimental rock bits, like the drag bits, have the mud stream or "jet" directed to flush the cuttings from the bottom rather than to clean the cutters. With the experimental bits now being tried in some areas, jet rock bits have drilled on average of 65 per cent more footage per bit—70 per cent faster—than with a conventional rock bit.

Modern Light-Oil Refinery

(Continued from page 112)

trim heaters for "lined out" tower operation.

The accompanying refinery processing flow diagram is briefly outlined below. Crude-tower bottoms (25° A.P.I. gravity) are charged directly to the catalytic feed-preparation units. Straightrun gasoline is stabilized and light-naphtha cut is pumped to tankage as reformer charge stock. Kerosine production is charged directly to the kerosine treater.

The Houdry fixed-bed and T.C.C. processes have similar feed-preparation units. Topped crude plus coker or vis-breaker gas oil and recycle gas oil are heated and flashed in a low-pressure separator. The flash tower overhead is superheated and charged to the catalytic unit reactors. Flash-tower bottoms of 19° A.P.I. gravity are charged directly to the delayed-coking unit. This stream rides on a back-pressure-controlled slop line which permits surplus flow to tankage, making possible the control of the coker-unit feed rate by the thermal-unit operators.

The synthetic crudes produced by the catalytic units are fractionated to produce gas, gasoline, distillate fuel oil, and synthetic crude bottoms. The distillate-fuel-oil fraction is continuously blended with a small quantity of light naphtha from the crude units to produce specification No. 2 and No. 3 fuel oils. Catalytic fractionator-tower bottoms are cooled and sent to tank-farm storage for use as charge to the gas-oil cracker coil of the new thermal unit. This intermediate tankage provides storage for the product during turnarounds of the gas-oil thermal cracking unit as well as allowing continuous operation of the gas-oil cracker with either the Houdry or T.C.C. units offstream

Some of the design and construction features incorporated in the new units are: (1) pressurized control rooms, (2) light green control panels and instrument housings, (3) utility rooms for use by the operators, (4) asphalt paving within the unit areas, (5) concrete paving around pump slabs and exchanger cleaning areas, and (6) craneways for handling pumps, exchangers and furnace tubes. Permanent pipe with steam, air, and water manifolding was installed in all furnaces for air-steam decoking. This system has been most successful both in time saved in cleaning heaters and in the final clean condition of furnace tubes. No new pump houses were built; this in addition to being an economy measure provides easier removal for maintenance and greater safety.

A study of the refinery steam requirements indicated a need for a flexible steam system which would economically handle turnarounds on units producing steam from waste-heat boilers as well as fluctuating loads due to seasonal demands. Three of five existing boilers were converted

TABLE 1—INSPECTION DATA, REFINERY STREAMS

	Straight-run gasoline	Crude unit light naphtha	Crude unit kerosine	Topped crude	Catalytic flash tower bottoms	Catalytic gasoline
Gravity	66.0	49.0	42.5	25.0	19.0	52.0
10 per cent	142	316	382	...	...	158
50 per cent	216	342	430	...	...	318
90 per cent	270	380	494	...	...	410
Flash	...	98	135	...	...	...

	Catalytic distillate fuel oil	Syn. crude bottoms	Coker gas oil	Thermal unit gasoline
Gravity	32.0	24.0	33.0	63.0
10 per cent	494	630	402	136
50 per cent	530	690	544	252
90 per cent	590	...	728	370
Flash	180	...	...	...
Pour	0	...	...	...

TABLE 2—YIELDS, DESIGN BASIS

Gasoline, bbl. per day	15,000-19,000
Light burning oils, bbl. per day	7,000-10,000
Heavy fuel, bbl. per day	800- 6,000
Coke, tons per day	0- 250

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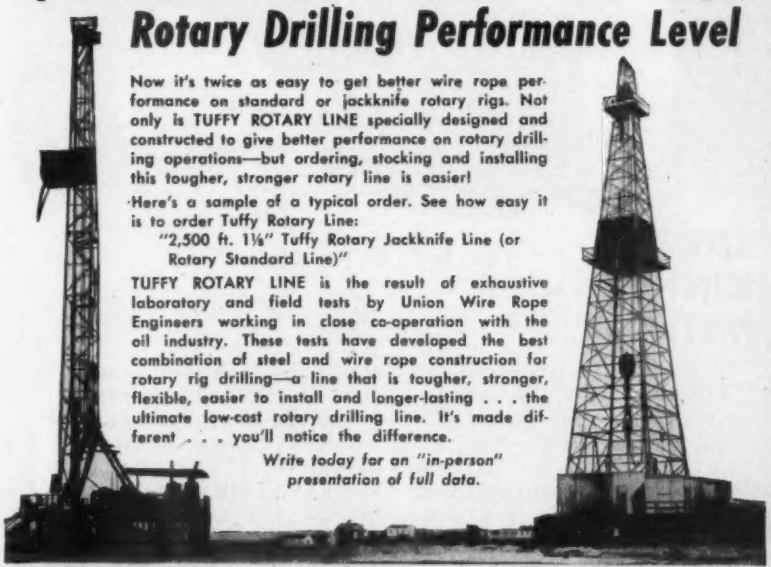

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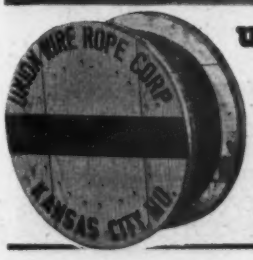

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from 180 to 380-psig. service, and water-cooled walls were added to these three boilers. The steam system now includes three loops, 380, 180, and 25 psig., for supplying all steam power and processing requirements. Turbine-drive units now operate on differentials of 380 to 180 psig., 180 to 25 psig., and 25 psig. to vacuum. Steam condensate is returned as boiler-feed makeup from these systems and supplies 40 per cent of demand.

Increased cooling-water requirements are supplied by a new 20,000-g.p.m. induced-draft cooling tower. This tower replaced an existing spray pond which had a dual service as a fire-water reservoir. To assure an adequate supply of water for fire-fighting equipment, a 41,000-bbl. water-storage tank was constructed. The top 12 ft. of this tank is used as a water-surge makeup for the water-treating plant.

Electrical and Fuel Systems

The electrical-distribution system within the refinery was also revised. Nine new load-center substations totaling 10,750 kva. were installed. The 13,800-volt system was modernized by the installation of metal-clad switch gear for protection of the primary feeders. The local utility company has installed an underground 13,800-volt feeder for the refinery's sole use; in addition, there is an overhead feeder automatically available as an emergency source of power. Refinery power outages are reduced.

The refinery fuel system utilizes refinery gas with trim heat requirements furnished by oil. Automatic combustion-control equipment at the boiler house balances fluctuations in refinery fuel gas by dual firing with oil and gas, thus utilizing all of the refinery gas. The fuel-gas system has been revised to include a single loop with automatic pressure control to preferentially favor processing units with fuel gas and placing the fluctuating fuel loads on the automatic combustion equipment at the boiler house. The conservation of refinery gas is also assisted by a new 28,000-cu. ft. sphere connected to the system. Gas surges are thus minimized by varying pressure in sphere from 65 to 15 psig.

To accommodate the new high-pressure thermal equipment the refinery flare system required revamping. A dual-purpose blowdown tank was installed to serve as a quench for the thermal furnace dropout lines as well as a blowdown tank for the delayed-coking drums. Two relief flares are provided with crossmanifolding so that either flare may be made idle for maintenance. Normally, one flare is valved for service with the high-pressure equipment and the other flare serving as a relief for the low-pressure equipment.

Truck and barge-loading facilities were modernized by replacing much of the old equipment formerly used for these purposes. The truck-loading rack is centrally located between working tankage and finished storage, making possible dual service of lines and pumps. The rack is a self-service type. Meter readings are used for all billings. A new all-steel loading dock was constructed nearby on the Mississippi River for handling barge shipments.

The new units added very little increased refinery waste water; however, in line with the industry's continued interest in stream pollution, a new A.P.I. separator was installed in series with an existing installation. A primary skimming of the refinery effluent is effected in a new flume prior to the A.P.I. separator.

The completion of the construction at East St. Louis is one step in Socony-Vacuum's expansion program which has included additions to a majority of its refineries in the United States. The primary contractor for the East St. Louis program was Bechtel Corp. of San Francisco. The refinery-engineering division of Socony-Vacuum in New York City cooperated with the local technical and engineering division in planning and process engineering.

Previous Article

"Socony-Vacuum's East St. Louis Refinery Undergoing Extensive Remodeling," September 2, 1948, page 74, The Oil and Gas Journal.

A NEW and BETTER WAY to REMOVE PARAFFIN from FLOW LINES

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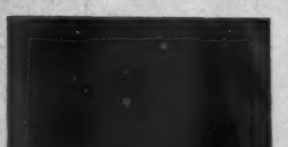
A strange breed of "cat" ... cat-equipment, that is!

ONE of the unusual types of equipment Kellogg is frequently called upon to fabricate is the cat-poly reactor. A strange breed of heat exchanger, it is in reality a combination pressure vessel and heat exchanger, inasmuch as operating pressures in the catalyst-packed tubes reach 1200 psi. Another unusual aspect of these exchanger-vessels is that they are designed to be taken out of service regularly for replacement of catalyst, rather than being built to operate without maintenance for as long a period as possible.

Fabrication of this type of equipment is unusual, too, in the heat exchange field. First, it's on the "grand" scale, tubes being 5 inches in diameter and 40 feet long, and the shells 50 inches in diameter. But probably the most important single fabrication step is *the welding of the tubes to the tube sheets*, replacing the customary roll-in operation. Here Kellogg's unusually broad experience in welding techniques asserts its importance... guarantees the customer finished cat-poly reactors in the minimum time with the maximum service life built in.

One recent order!

An even dozen Kellogg cat-poly reactors are installed in this brand new East Coast refinery. Another three-quarter dozen are now being finished in Kellogg shops, destined for a Midwest plant operated by the same refiner.



Continuing Basic Study of the principles of heat exchange conducted by Kellogg development groups for more than twenty years has produced unduplicated design data.

Shop Layout Craftsmen are fully experienced on all types of heat exchanger fabrication from gigantic marine condensers to intricate jet motor combustion-chamber shells.

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Special Shop Techniques permit the economical fabrication of the component parts for each heat exchanger as an individual production order and provide every exchanger with the advantages of "tailor-made" fit and serviceability.

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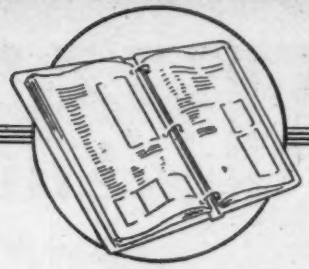

THE REFINER'S notebook

Reset Rate

PROPORTIONAL response is characterized by the fact that there is but one definite output air pressure (or valve position) corresponding to any one particular pen position. Deviation from the set point occurs when correction is made for sustained load change. In order to hold the controlled variable at the set point, it is necessary that there be different valve openings for any one particular pen position.

Floating action.—One way of obtaining several valve openings for any one given pen position is to adjust the set point manually and this shift may be made anywhere within the pressure range of the instrument at any particular throttling range. In other words the throttling range is shifted up or down across the scale or range of the controller to obtain the valve opening which will bring the controlled variable back to the set point. This was illustrated in Fig. 2, installment No. 27 of the Refiner's Notebook. Another method is to combine proportional response with floating action so that manual reset of the control index is not required. Floating action is in this case more properly termed "proportional-speed floating" to distinguish it from other types of floating action.

In proportional response the change in output air pressure is directly proportional to the deviation or change in controlled variable. The rate of change in output pressure (psi. per minute) is directly proportional to rate of change in temperature (°F. per minute). Adjustment of the throttling range in the proportional controller means alteration only in the magnitude of output pressure change. The direct proportionality between pen movement and output air pressure is not affected.

In the case of floating action the rate of change in output pressure or speed of opening of the control valve is proportional not to the speed of temperature change but to the deviation itself. If, for example, temperature is being controlled the air pressure will change twice as fast for a 2° F. change as for a 1° F. change. Proportional-speed floating action recognizes both elapsed time of deviation as well as magnitude or amount of deviation.

Reset rate.—Determination of reset rates may be made as described, for instance, by Allen.[1] The throttling range is adjusted to give a 1-psi. output air pressure change for a pen deviation equivalent to one major chart division. An artificial load change is introduced by moving the pointer one major chart division. There will be an initial (instantaneous) change of 1 psi. in output air pressure. This corresponds to the proportional or throttling action. The sudden change of 1 psi. is followed by a gradual continuous change in output pressure (corresponding to the floating action) which may be allowed to proceed for a given period of time checked by a stopwatch. The reset rate would then be the ratio of the gradual continuous change in psi. per minute to the initial instantaneous change (1 psi.).

$$\text{Reset rate} = \frac{\text{psi. change during timed period}}{\text{av. time (min.)} \times \text{initial psi. change}}$$

$$= \text{psi. per min. per psi. initial change}$$

$$= \text{a number per minute}$$

This illustrates the definitions of reset rate given in the previous installment. When defined in this manner a given reset rate is independent of the throttling range setting and of the deviation of the controlled variable.

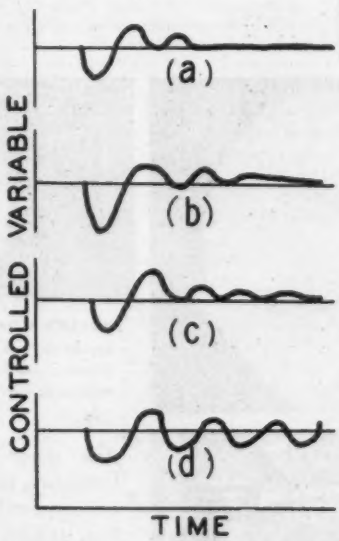

Fig. 1—Effect of increasing the reset rate is shown here. The curve (a) was obtained with zero reset rate at optimum throttling range. Successive increase in reset rate finally resulted in continuous cycling, curve (d). Optimum reset rate in this case was taken between (b) and (c).

Optimum reset rate.—Effect of increasing the reset rate is indicated in going from (a) to (b) in Fig. 1. Assuming that the throttling range has been properly adjusted, with reset rate at zero, the curve (a) is obtained. Successive increase in reset rate will finally result in continuous cycling as at (d). Optimum reset rate is between (b) and (c) or quite close to (c). It may be determined, as suggested by Nuneviller and Vollrath,[2] by noting the **period of cycling** which is the time in minutes between peaks of two successive cycles on the pen record obtained at the optimum throttling range. The optimum reset rate may then be taken as the reciprocal of the cycling period.

References

1. Allen, Industrial and Engineering Chemistry 35, p. 1223 (1943).

2. Nuneviller and Vollrath, Instrumentation, July-Aug. 1945, p. 27.

3. Ziegler and Nichols, Trans, A.S.M.E. 64, p. 759 (1942).

No. 34 in current series. The Refiner's Notebook has been published continuously since 1944.

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Case Histories and K_g/K_o Curves

IT has been noted that the relative-permeability curve calculated from field data will depend upon (1) the type of reservoir drive, (2) the production practices, (3) the estimation of oil in place, and (4) the estimation of connate water in place (see Engineering Fundamentals No. 413). It will also depend upon the type of reservoir rock, or more exactly upon the pore channel configurations within the reservoir rock. The converse statement would show cause and effect more clearly; that is, production history of the reservoir is dependent upon the relative-permeability characteristics of the reservoir, which are in turn dependent upon the pore configurations within the reservoir rock. In engineering practices the relative-permeability-ratio curve is sometimes used to interpret production history and the production history is sometimes used to evaluate a relative - permeability - ratio curve.

The effect of the relative-permeability character of a rock on production history by gas displacement lies in its effect upon the producing gas-oil ratio. In this respect its control is similar to that of the oil viscosity (Engineering Fundamentals No. 412). By definition, K_g/K_o gives gas flow compared to oil flow. More exactly, the producing gas-oil ratio is given by the familiar equation:

$$R = \frac{K_g}{K_o}\,\frac{\mu_o}{\mu_g}\,\frac{\beta}{v} + r$$

Thus, for a given reservoir pressure (which would fix the viscosities, the formation volume factor, and the gas in solution) the gas-oil ratio is directly proportional to K_g/K_o. Because there will be only a limited amount of gas available in the reservoir, the faster the gas-oil ratio increases with respect to cumulative production the less will be the total cumulative production by the time the gas is entirely produced. Therefore, the faster the value of K_g/K_o increases the less will be the production of oil. In this respect the increase of the relative-permeability ratio can be looked upon as a measure of efficiency. It is assumed in making this statement that no factors vary except K_g/K_o.

On this basis, the curves of Figs. 1 and 2 are shown to be related. Fig. 1 shows two relative-permeability-ratio curves (K_g/K_o versus oil saturation). That marked A increases more rapidly in value than that marked B. Corresponding production-history curves for the two reservoirs possessing these relative-permeability properties are shown in Fig. 2 as A and B. It is reiterated that this effect is very similar to that experienced by a change in reservoir oil viscosity because a change in either variable produces the same relative change in the producing gas-oil ratio.

Converse to the interpretation of production history as shown in Fig. 2 by the curves of Fig. 1 is the calculation of field K_g/K_o curves from production history, and the correlation of these curves with the pore geometries of the reservoir rocks. A number of calculated curves have been reported in the literature[1] but no one has yet been able to show distinctly that variations are unique with the type of porous media. It is generally conceded by most petroleum engineers that reservoirs with uniform porosity, such as is possessed by an unconsolidated sand, will give curves of lower slope than will reservoirs of nonuniform porosity, such as is possessed by vugular or fractured limestones.

Fig. 3 illustrates the variations reported by one author.[2] On this figure are shown the envelope limits for the curves calculated on the reservoirs designated. These curves are plotted versus total reservoir liquid saturation.

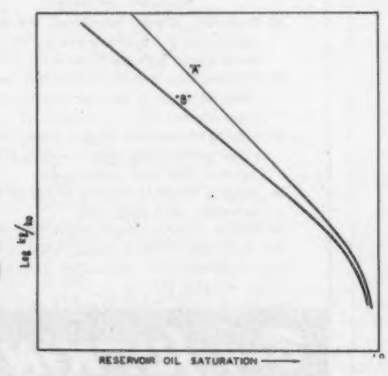

Fig. 1

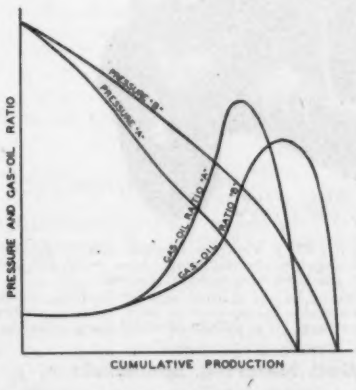

Fig. 2

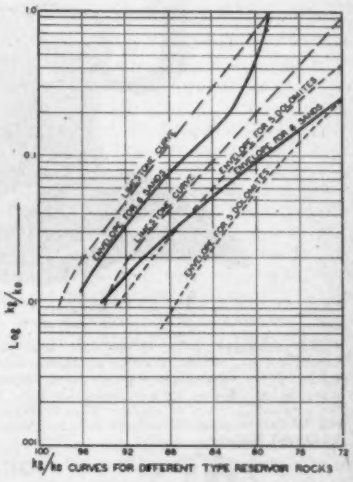

Fig. 3 (Reference 2)

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1. Importance of Injected Gas as a Driving Medium in Limestone Reservoirs, L. E. Elkins, A.P.I. Drilling and Production Practice 146, p. 160.
2. Clark, J. D., M.S. Thesis, University of Oklahoma, 1948.

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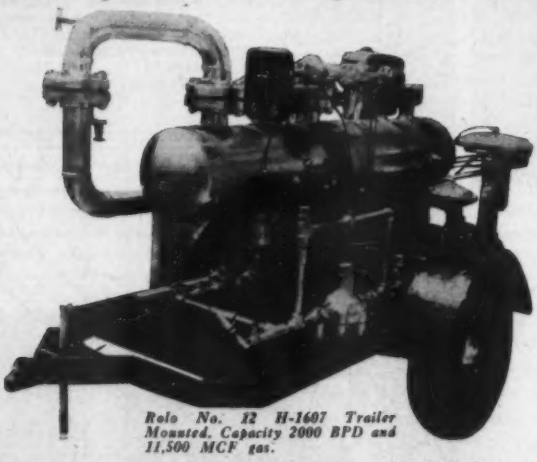

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NATURAL GAS

Storage Hearings Expedited

WASHINGTON. — Getting New Yorkers the natural gas needed for the 1951-52 winter is the aim of the Federal Power Commission in expediting hearings that will determine the construction of gas-storage facilities.

Intermediate procedure has been cancelled in applications made by New York Natural Gas Corp. and Texas Eastern Transmission Corp. The speedup was protested by Tennessee Gas Transmission Co. and Transcontinental Gas Pipe Line Corp.

The FPC ruling was the result of evidence indicating that operation in the storage area must await construction of a 30-in. pipe line from Teaxs Eastern's transmission facilities, the drilling of several wells, and installation of a compressor station.

Storage operations must be commenced in 1951 to have gas available for winter distribution as required by the proposed customers of New York State Natural Gas Corp.

Texas Eastern and New York State Natural propose jointly to acquire, develop, and operate underground gas-storage facilities in Westmoreland County, Pennsylvania. Combined cost of the project is $40,772,992. A portion of the properties located within the Oakford storage area would be acquired from Peoples Natural Gas Co. of Pittsburgh, an affiliate of New York State Natural. The project calls for 105 miles of new pipe line and construction of a 30,000-hp. compressor station.

Rate-Increase Hearing Set

WASHINGTON. — Proposed rate increases involving $3,200,000 yearly are challenged in the Federal Power Commission hearing set for August 28, to consider tariff requests filed by Northern Natural Gas Co. The hearing concerns the lawfulness of the rates, charges, and classifications.

The commission has granted intervening petitions filed by Iowa Power & Light Co., Minnesota Valley Natural Gas Co., Minneapolis Gas Co., Central Electric & Gas Co., and Council Bluffs Gas Co. It finds that the participation of these companies may be in the public interest.

New England Bid Advanced

WASHINGTON. — New England's need for natural gas has prompted the Federal Power Commission to eliminate the usual intermediate procedure and waive oral arguments on pending applications for gas-distribution service. September 1 is the date set for briefs to be filed by Tennessee Gas Transmission Co., Transcontinental Gas Pipe Line Corp., New York State Natural Gas Corp., and Niagara Mohawk Power Corp., and to a limited extent on Algonquin Gas Transmission Co.

FPC found that "due and timely execution of its functions imperatively and unavoidably requires that intermediate decision in these proceedings be omitted."

Public groups in New England have stressed the urgency for early action to provide the flow of natural gas into that area.

Findings of research groups have emphasized the saving which natural gas would bring to industry and to communities, compared with the present fuel supply.

Protest Lower Pressure

WASHINGTON.—Loss from lowered gas pressure is set forth in a complaint made by Syracuse Suburban Gas Co. against Niagara Mohawk Power Corp. Hearing on the charges has been set by the Federal Power Commission for September 5.

Syracuse Suburban alleges that Niagara Mohawk plans to reduce the pressure maintained in the past when it completes a new high-pressure line from Therm City to DeWitt, N. Y.

The complaint recites that Niagara Mohawk is unwilling to guarantee pressure in excess of 1 psi. in summer and 2 psi. in winter months, compared with present pressure of 2-5 psi. in summer and 3-6 psi. in winter months.

Contract Is Awarded

HOUSTON. — Delta Engineering Corp. has been awarded construction contract from Arkansas Louisiana Gas Co. for a compressor station at Blanchard, La., which will have a daily capacity of 65,400,000 cu. ft.

The station, rated at 4,200 hp., is scheduled for completion in late 1950.

Gas For Georgia Towns

WASHINGTON.—Five communities in Georgia and South Carolina are given access to natural gas under a ruling of the Federal Power Commission.

Transcontinental Gas Pipe Line Corp. has been ordered to deliver natural gas to South Carolina Gas Co., Gaffney, S. C.; to the cities of Lavonia, Buford, and Sugar Hill, Ga.; and to Gainesville, Ga., should that city elect to construct its own distribution system, or to the Georgia Gas Co. for distribution in Gainesville if no municipal system is provided.

Transcontinental is required to tender certain specified quantities. South Carolina Gas Co. is limited to 1,000,000 cu. ft. daily; Lavonia to 512,000 cu. ft. daily; Buford to 561,000 cu. ft. daily, and Sugar Hill to 149,000 cu. ft. per day.

The ruling denied service to Demopolis, Dadeville, Camp Hill, and Lafayette, Ala.; and West Point, La Grange, Hogansville, and Grantville, Ga.

Rate Increases Granted

WASHINGTON. — Rate increases were granted Atlantic Seaboard Corp., Charleston, W. Va., for wholesale natural gas service to two customer companies when the Federal Power Commission lifted the suspension it had decreed in April. Two other customers remain under suspension.

Atlantic Seaboard revised its earlier sales and revenue estimates for service to Washington Gas Light Co. of Maryland, and Maryland Counties Gas Co., indicating an annual reduction of $1,316 instead of the previously estimated increase of $477.

FPC scheduled a hearing to commence August 28 on the portion of the suspension still in effect. The schedules involved apply to Washington Gas Light Co., with an annual increase of $348,000, and Manufacturers Light & Heat Co., with an increase of $1,237.

Natural Gasoline

Silver Anniversary

LOS ANGELES. — An extensive program of technical forums and presentation of various papers pertinent to the natural-gasoline industry will highlight the celebration of the California Natural Gasoline Association's twenty-fifth anniversary here November 9-10.

Forums and discussions led by past presidents of the association are programmed for the first day, and will include papers on: "Efficient Operation and Maintenance of Plant Equipment," "Application of Chemical and Process Engineering Principles to the Efficient Design and Operation of Natural Gas Processing Plants," "Role of the Chemist and Laboratory in Efficient Natural Gas Operations," "Efficient Mechanical Design of Natural Gas Processing and Compression Plants and Natural Gas Gathering and Distributing Systems" and "Efficient Management of Natural Gas and Natural Gasoline Operations."

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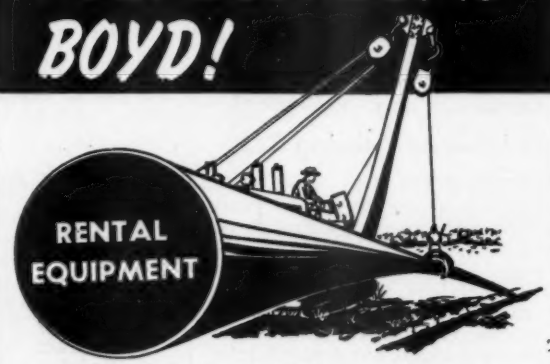

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PIPE LINES

Projects Report

Williams Bros. completing crude-oil line in Canada

THE Williams Brothers Corp. of Canada, Ltd., is completing 32 miles of 16-in. crude-oil line from the Redwater field to Edmonton, Alta., Canada, under J. C. Virgin, general superintendent for Imperial Oil interests.

Williams Brothers Corp., a different firm from the Williams Brothers of Canada, Ltd., has three spreads under direction of Guy S. Connors, vice president, laying the Regina-Gretna section of the Interprovincial Pipe Line Co. system. The spread based at Verden, Man., under Clyde Gregory, has completed the Kipling-Regina section. B. E. Barnes is superintendent of the spread working out of Maryville, Sask., in addition to being general superintendent of the entire Regina-Gretna job.

The spread at Glenboro, Man., under O. L. (Whitey) Martin, is approaching the end of a 106-mile section. The project office is at Brandon, Man., under E. F. Slattery. For expediting immigration, exporting, and importing matters, the firm has an office at Neche, N. D., under L. C. Watson. For the entire 340-mile Regina-Gretna section contracted by Williams Brothers (consisting of 306 miles of 16-in. and 34 miles of 18-in.) 250 miles had been completed by August 15.

Syrian operation.—The Lebanon-Syria-Jordan section of Trans-Arabia Pipe Line Co.'s project is being buil by Williams Brothers Overseas Co under A. M. Garber, manager. Tw main-line spreads are supervised by J. H. Humphries and George Allen; the Sidon terminal gang is under J. H. McCartney. S. Miller Williams, president, is returning from Lebanon, August 25. After that date David R. Williams will be at the company's Beirut, Lebanon, office.

In the United States, laying of a Mississippi River crossing and land lines is being done for Minneapolis Gas Co. in the Minneapolis area by gangs under Earl Taylor and Floyd W. Caldwell. At Louisville and La Grange, Ky., Williams Brothers Corp. has a gang under C. E. Cooper laying for Louisville Gas & Electric Co. Crews under H. W. Franks are laying for Atlanta Gas Light Co. in the Atlanta, Ga., area and for Alabama Gas Co., near Tuscaloosa, Ala.

The Savannah River crossing for Transcontinental Gas Pipe Line Co is being laid under Thelmer Davis superintendent, to complete a 196-mile, 30-in. section.

Williams Brothers-Davis Co., Houston, is laying 85 miles of 30-in. southwest from the San Jacinto River, Texas, for Transcontinental Gas Pipe Line Co. Work is directed from a Humble, Tex., field office by H. L. Davis, president.

Tulsa Williams Co., under supervision of David R. Williams, general

ONE OF MANY OBSTACLES.—H. C. Price Co. crew is shown lining up two sections of heavy casing in a mud hole 10 ft. below the surrounding surface, on Tennessee Gas Transmission Co. job. At this point the natural-gas line to Buffalo tunnels beneath both a railroad and a concrete highway.

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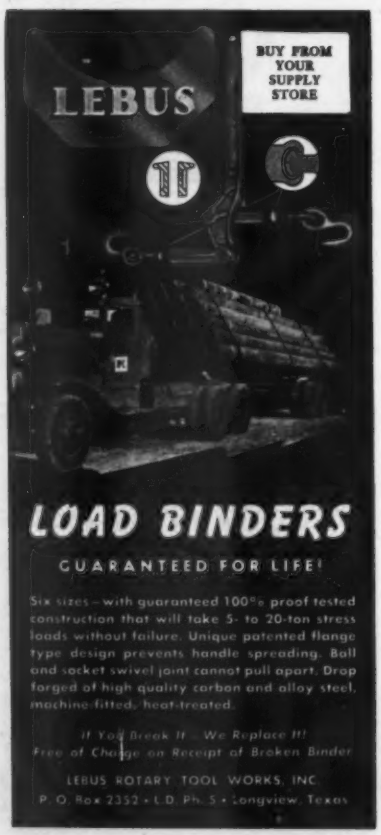
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superintendent, is building crossings at the Rahway and Raritan rivers in New Jersey for Transco. Ernest Tierney supervises the work from a field office at Woodbridge, N. J.

In September Tulsa Williams Co. will lay 24 miles of 20-in. from the Ohio-Pennsylvania boundary to the Austintown station for East Ohio Gas Co. This will be under A. T. Maxwell. This firm will lay 42 miles of 20-in. for Peoples Natural Gas Co. starting September 1, in the vicinity of Mars or Bakerstown, Pa.

Transco Obtains Loan

A short-term bank loan has been obtained by Transcontinental Gas Pipe Line Corp. to complete the financial program for expanding the line's capacity from 340,000,000 to 505,000,000 cu. ft. of gas per day.

Arrangements to obtain $7,350,000 have been completed with Chase National Bank, J. P. Morgan & Co., and Chemical Bank & Trust Co., with provision to borrow an additional $2,650,000, if needed, any time up to January 2, 1951.

Previously Transcontinental had sold $32,000,000 of 3¼ per cent first-mortgage pipe-line bonds, due in 1970, to 18 insurance companies.

The present loan completes approximately $240,000,000 of financing for construction of Transcontinental's 1,840-mile Texas-to-New York pipe line which is scheduled to begin delivery of natural gas late this year. The company's capital structure, exclusive of short-term borrowings, now comprises $175,000,000 first-mortgage pipe-line bonds, $26,500,000 interim notes, and 3,530,000 shares of common stock.

Meanwhile, cost of a 98-mile natural-gas pipe line to connect Transcontinental's main line with Raleigh, N. C., has been estimated at $2,304,500 by Public Service Co. of North Carolina. This is the longest lateral the company proposes in a 303-mile system for which it is asking Federal Power Commission authorization.

The Raleigh lateral would connect with Transcontinental between High Point and Winston-Salem, two of the 50 North Carolina communities which Public Service Co. seeks to serve.

Pipe Lines Being Raised

Three parallel 8-in. crude-oil pipe lines between Dallas and Corsicana, Tex., are being taken up by O. R. Burden Construction Co. The 177 miles of pipe was acquired from Texas Pipe Line Co., and sold by Burden to a Houston group. The removal is supervised by Barney Hall.

In the Lockport, Ill., area, Burden is laying 6 miles of 12-in. pipe between refineries of Globe Oil & Refining Co. and The Texas Co.

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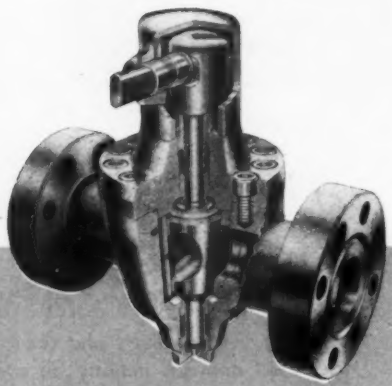

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Pipe-Line Construction

FOLLOWING is a tabulation of domestic pipe-line projects which are planned or under construction. Included are crude-oil, products, and natural-gas lines. The list was compiled from surveys made by The Oil and Gas Journal.

Crude-Oil Pipe Lines

Humble Pipe Line Co.—371 miles, 18-in., under way, West Texas-Satsuma Station to Baytown, Tex.; 178-mile western section contracted to Morrison Construction Co.

30 miles, 8-in., Runnels and Coke counties, Texas, planned.

Lakehead Pipe Line Co.—320 miles, 18-in., Neche, N. D., to Superior, Wis.; Anderson Brothers Corp., contractor. K. B. Killingsworth, Pembina, N. D., Earl Saulsman, Clearbrook, Minn., and J. D. Jackquemine, Bemidji, Minn., spreadmen. Under construction.

Magnolia Petroleum Co.—60 miles 4-24-in. gathering system in La Ward and Lolita fields, Texas; Henry L. Lemons & Co., contractor; W. A. Remington in charge.

Mid-Valley Pipe Line Co. (Sun and Sohio)—1,000 miles, 20-22-in., under way, Longview, Tex., to Mayersville, Miss.-Covington, Ky., to Lima, Ohio. Contracts let for 857 miles as follows: Section 2, Haynesville, La., to Mayersville, Miss., completed. Section 3-A Mayersville to Oakland, Miss., Associated Pipe Line Contractors, Inc.; J. A. Williams and L. H. Gray, spreadmen; field office, Charleston, Miss.; Section 3-B 4-A, Oakland, Miss., to Henderson, Tenn., Houston Contracting Co., E. C. Norris, superintendent; field office, Batesville, Miss.; Section 4-B, 5-A, Henderson to Clarksville, Tenn., Eastern Construction Co.; work started April 1; to be completed by September 1, 1950. Louie Stewart and Cliff Simmons, spreadmen; field offices, Clarksville and Lexington, Tenn. Section 5-B, 6-A, Clarksville, Tenn., to Elizabethtown, Ky., field office, Clarksville, Fred L. Byers, superintendent; Britton Construction Co.; Section 6-B, 111 miles of 22-in., Elizabethtown to Hebron, Ky., H. L. Gentry Construction Co., Frank Morris and Jim Mitchell, spreadmen; field office, Warsaw, Ky., Section 7 South, Hebron, Ky., to Eaton, Ohio, Britton Construction Co., field office, Hamilton, Ohio; spreadman, Fred Peters; Section 7 North, Eaton to Lima, Ohio; Section 8, Magnolia, Ark., to Haynesville, La. Longview, Tex.-Haynesville, La., section, 110 miles 20-in., contracted to O. R. Burden Construction Co.; G. A. Lewis, spreadman; office, Marshall, Tex.

Cumberland and Tennessee rivers, Eastern Construction Co.; field office, Clarksville, Tenn., Fred L. Byers, spreadman.

41 miles, 20-in., Haynesville, La., to Red River near Benton La.; Latex Construction Co., contractor; H. L. Leake, superintendent; headquarters, Cotton Valley, La. W. A. Briley, assistant superintendent; Sam B. Harrison, office manager.

Naph-Sol Refining Co.—25 miles 6-in., under construction, Kimball Lake oil field, Newaygo County, Michigan, to refinery at Muskegon; Young Construction Co., Olney, Ill., contractor.

Pan American Pipe Line Co.—80 miles, 10-in., southern part of Scurry County, Texas, to connect with Humble Pipe Line Co.'s system near San Angelo, Tex. Brown & Root, contractor.

Pelican Oil Co.—60 miles, 6-in., Lake Charles, La., area; Anderson Brothers Corp., contractor; field office, De Quincy, La.; R. W. Jernigan, spreadman. Under construction.

Phillips Petroleum Co.—45 miles 2-24-in., gathering system near Andrews, Tex.; Vaughn & Taylor Construction Co., contractor; Jess Moore in charge.

281 miles 10-in., planned, Borger, Tex., to Yale, Okla.

Pasotex Pipe Line Co.—32 miles 4-8-in., authorized, North Snyder, Tex., lines for gathering, delivery to Basin System.

Portland Pipe Line Co., Montreal Pipe Line Co., Ltd.—236 miles, 18-in., planned, Portland, Me., to Montreal, Que., Canada, contracted as follows: Oklahoma Contracting Co., 85 miles in Section 1 at southern end; Portland, Me., to Gorham, N. H.; H. A. Wylie, superintendent; Lisle W. Chambers, paymaster; office, Barton, Vt.; work starts June 1. Associated Pipeline Contractors, Inc.; L. H. Gray, spreadman. Section 2, 81 miles; and Fred Mannix Co., Ltd., 68 miles, Section 3, in Canada.

Richfield Oil Corp.—40 miles, 10-in., Cuyama Valley-Newhall, Calif., planned. 60 miles, 14-in., applying field joints, Newhall-Wilmington, Calif., under way.

Stanolind Pipe Line Co.—36 miles, in Kent County, Texas, outlet for Scurry County crude.

Texas-Empire Pipe Line Co.—42 miles, 16-in., authorized, Wilmington, Ill., to East Chicago, Ind.; O. E. Burden Construction Co., contractor; O. P. Hines, spreadman; office, Chicago Heights, Ill.

Texas Pipe Line Co.—42 miles 12¾-in., Patoka, Ill., to Clay City, Ill.; L. R. Young Construction Co., contractor; field office, Flora, Ill.: Whity Ralph, spreadman.

Texas-New Mexico Pipe Line Co.—37 miles, 10-in., proposed, Scurry County, Texas.

Products Pipe Lines

Essaness Corp. (Sohio and Shell).—57 miles 8-in., planned, Lima to Springfield, Ohio.

Great Lakes Pipe Line Co.—261 miles, 12-in., under way; contracted as follows: A. C. Holder Construction Co., 72 miles to Iowa-Minnesota state line; Williams Brothers Corp., 20 miles, Mississippi River crossing and line to terminal and station. Kansas and Missouri river crossings, R. H. Fulton & Co.; field office, Kansas City; Ed Veach, spreadman.

Second 12-in. line to be constructed between Barnsdall, Okla., and Kansas City, Kans., paralleling the 12-in. recently completed, and three existing 8-in. lines. Work to start as soon as pipe is delivered.

47 miles, 12-in., Atchison, Kans.,-Fall City, Neb.; Midwestern Constructors, Inc., contractor; field office, Falls City. This firm has following contracts, also: 47 miles, 12-in., Falls City to Nebraska City; field office, Nebraska City; and 48 miles, 12-in., Nebraska City to Omaha; field office, Plattsmouth, Neb.

236 miles, Barnsdall, Okla.-Kansas City, Mo., Pacific Pipe Line & Engineers, Ltd. James Howe, superintendent for Pacific Pipe Line portion is headquartered at Chanute, Kans.; spread office at Tulsa with Ham Hamilton general spreadman and river-crossing spreadman; spread office at Dewey, Okla., Loue Robertson, spreadman; and spread office at Paola, Kans., Larry Webb, spreadman.

355 miles, 12-in., authorized, Kansas City through Omaha and Sioux City, Iowa, to Sioux Falls, S. D.

189 miles, 12-in., authorized, Kansas City to Des Moines, contracted as follows: 36 miles 12-in., Kansas City, Mo., northward through Platte, Neb.; Trojan Construction Co., contractor; field office, Parkville, Mo.; Swede Tillotson, spreadman; 37½ miles, 12-in. Clay, Clinton, DeKalb, and Daviess counties, Missouri; Trojan Construction Co., contractor; field office, Cameron, Mo.; Felix Johnson, spreadman; Brodie Construction Co., 37-mile middle section; field office, Bethany, Mo.; A. T. Rathjen, spreadman; R. H. Fulton & Co., two 38-mile northern sections, Osceola to Des Moines, Iowa; Jerry Nash, spreadman; office, Osceola.

48 miles, 8-in., authorized, Cushing-Drumright-Tulsa, Okla.; Trojan Construc-

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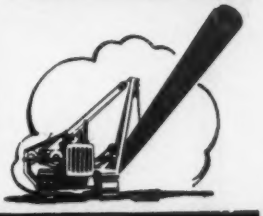

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tion Co., contractor; field office, Sapulpa Okla.; Slim Deaver, spreadman.

Miami Valley Corp. (Sohio and Pure).—58 miles 8-in., planned, Dayton to Cincinnati.

Phillips Petroleum Co.—155 miles 6-in., extension to present 200-mile line from Phillips, Tex., to LaJunta, Colo., on to Denver.

Plantation Pipe Line Co.—New 14, 18-in. products line planned paralleling existing 456-mile, 12-in. from Baton Rouge, La., to Bremen, Ga., and 357 miles 10-in., Bremen to Greensboro, N. C. Work to begin January 1, 1951.

Standard Oil Co. (Ohio).—38 miles 8-in., authorized, Toledo to Fostoria, Ohio.

Salt Lake Pipe Line Co.—242 miles, 6-8-in., Boise, Idaho-Pasco, Wash., planned. Contracted as follows: Morrison-Knudson Co., Inc., Macco Corp., and Bechtel Corp., 140-mile section from Boise to Baker, Idaho; Pacific Pipeline & Engineers, Ltd., Baker to Pasco, Wash. Pacific Pipeline & Engineers, Ltd.'s, field office, LaGrande, Ore.; L. E. Robertson, spreadman.

63 miles 8-in., Mountain Home to Boise, Idaho; Oklahoma Contracting Corp., contractor; Aldress Kilgore, supt.; R. F. Mueller, paymaster. Office, Mountain Home. Construction under way.

Susquehanna Pipe Line Co.—125 miles 8-in., under way, Toledo to Sarnia, Ont. H. L. Gentry Construction Co., contractor.

Tuscarora Oil Co. (Esso).—360 miles, 10-12-in., Linden, N. J., to Pittsburgh; replacement of present line.

Natural-Gas Pipe Lines

Alabama-Tennessee Natural Gas Co.—80 miles 10-in., under way, Selmer, Tenn., to Muscle Shoals, Ala.; 35 miles 8-in., authorized, Muscle Shoals to Decatur, Ala.

Algonquin Gas Transmission Co.—276 miles, Lambertville, N. J., to Boston area, proposed.

492 miles laterals, New England area, proposed.

Arkansas-Louisiana Gas Co.—69 miles, 20-in., Waskom, Tex., to Magnolia, Ark.; under construction; Anderson Brothers Corp., contractor; Ralph Pitts, spreadman; field office, Plain Dealing, La.

Associated Pipe Line Co.—35 miles, 14½, 8⅝-in., in southeastern Missouri, approved.

Atlantic Gulf Gas Co. (United Gas Pipe Line Co.)—1,530 miles, planned, Alabama-Florida-Georgia-South Carolina.

Central Hudson Gas & Electric Corp.—40 miles, authorized, Tuxedo, N. Y., station. Home Gas Co. line now under construction to Poughkeepsie, N. Y. Britton Construction Co., contractor; field office, Newburgh, N. Y.; spreadman, Curley Hahn; R. L. Carlton, office.

Central Kentucky Natural Gas Co.—41 miles, 20-in., approved, Kentucky loops.

Chicago District Pipe Line Co.—41 miles, 24-in., planned, Joliet, Ill., to Chicago.

City of Indianapolis, Ind., Inc.—55 miles 16-in., proposed, Indianapolis to Texas Eastern Transmission Corp.'s system.

Cities Service Gas Co.—47 miles, 3-4-16-in planned, in Kansas.

Coastal Pipe Line Co.—1,000 miles planned, Texas to Norfolk, Va.

Colorado Interstate Gas Co.—215 miles 20-in., approved, Texas Panhandle to Kid Carson, Colo.

Colorado-Wyoming Gas Co.—41 miles planned, Greeley, LaSalle, and Windsor, Colo., areas. Vaughn & Taylor Construction Co., has contract for 30 miles, 10-in., Mesa to Boulder Junction, Colo.; field office, Derby, Colo.; Don Smith, spreadman.

Commonwealth Natural Gas Corp.—537 miles, 20-in., planned, West Bend, Ky., to Norfolk, Va.

200 miles, authorized, Green County, Virginia, to Norfolk; 104 miles 18-in. contracted to Ray L. Smith & Son, Inc., from Stanardsville to Richmond, Va. Don C. Smith, spreadman; field office, Orange, Va.; William G. Frost, spreadman; field office, Richmond. Also 84 miles 12-in., 20 miles 8-in. and laterals contracted to this company.

East Tennessee Natural Gas Co.—185 miles, 16-in., Lobelville-Chattanooga, Tenn., contracted by Walters & Saigh Construction Co., for construction in 1950; 120

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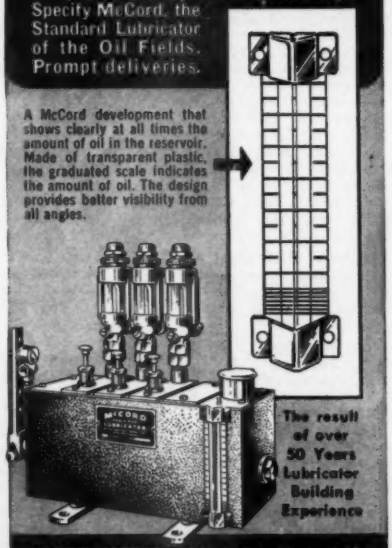

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miles, 12-in., Chatanooga-Knoxville, Tenn.; contracted by Walter and Saigh Construction Co., for construction in 1950; Robert E. Floyd, spreadman; field offices, Athens and Cleveland, Tenn.; Carl Doyle, general superintendent; James E. Gray, office manager; 100 miles of laterals to be laid in 1950. Construction 150 miles, 16-in., Knoxville-Bristol, Tenn., under consideration.

El Paso Natural Gas Co.—All work done by company crews.

Looping of 26-in., New Mexico-California line and connection with Pacific Gas & Electric Co. at Needles, Calif. 352 miles, 30-in., completion November 1950; spreads as follows: 119 miles 30-in., Wenden to Topock, Ariz., Ed Alsup, spreadman; office, Salome, Ariz.; (Spread No. 2 is shut down due to lack of pipe; office, Jal, N. M., Jack Smith, spreadman); 15 miles 2-in., Bowie, Ariz.; G. George, spreadman.

450 miles, 30-in., under construction, Eunice, N. M.-Blythe, Calif., looping; completion March 1950

450 miles, 24-in., approved, San Juan basin, New Mexico to Franconia, Ariz.

Home Gas Co.—70 miles, planned, Orange, Sullivan-Rockland counties, New York-Cattaraugus County, New York, areas.

Jersey Central Power & Light Co.—39.4 miles, 10-in., planned, New Jersey to Coast system, Texas Eastern Transmission Co.'s Big Inch.

Michigan-Wisconsin Gas Co.—185 miles 4-14-in. laterals, Milwaukee-Fond du Lac Sheboygan, and Green Bay, Wis., under construction; C. C. Griffis Construction Co., contractor; Paul Means, superintendent for Lake Del Mort crossing.

Montana-Dakota Utilities Co. and Montana-Wyoming Gas Pipe Line Co.—340 miles, 12¾-in. under way, Worland, Wyo., to Cabin Creek, Mont.; R. A. Conyes Construction Corp., contractor; Al Poggi, general superintendent; Chester Kincaid and Jimmy Alman, spreadmen; field office, Hardin, Mont.

Montana Power Co.—83 miles, 12¾-in., planned, Butte to Bozeman, Mont.; field office, Three Forks, Mont.; C. N. Deaton, spreadman.

New York State Natural Gas Corp.—83½ miles 16-in., loops, Pennsylvania.

164 miles, 16-in., Ithaca to Albany, N. Y., planned.

70 miles, 20-in., North Oakford storage pool, Pennsylvania, to Ohio State line.

53 miles, 16-in., loops in Pennsylvania, under construction.

56 miles, 20-in., loops in Pennsylvania and New York; under construction.

Northeastern Gas Transmission Co.—511 miles, up to 20-in., planned, in New England area.

Northern Natural Gas Co.—41 miles, 20-in., under construction, Southwest from Garden City, Kans.; R. H. Fulton & Co., contractor.

597 miles of looping in 10 sections, contracted as follows: R. H. Fulton & Co., loops 1 to 5; loop 1, 40.2 miles, 26-in., extending northward from a point 28.7 miles north of Skellytown station in Pampa, Tex., area; loop 2, Beaver, Okla., station, 74.9 miles, 26-in.; loop 3, Mullinville, Kans., station, 33¼ miles, 26-in.; loop 4, Bushton, Kans., station, 72½ miles, 26-in.; loop 5, from a point west of Garden City, Kans., to Bushton, Kans., station, 155 miles, 20-in. M. L. Boyd, spreadman; office, Perryton, Tex.; and N. A. Veach, spreadman; office, Liberal, Kans. Midwestern Constructors, Inc., loops 6 and 7; loop 6 from a point 29 miles northeast of Palmyra, Nebr., station, 43.4 miles, 26-in., to Oakland, Iowa, station; field office, Atlantic, Iowa; M. T. Wilbrite, supt.; Denner Franklin, asst. supt.; loop 7, from a point 17.8 miles northeast of Oakland, Iowa, station, 65.9 miles, 26-in.; office, Glenwood, Iowa. R. B. Potashnick, loops 8 to 10; loop 8, southwestward from Ventura, Iowa, station, 31.2 miles, 26-in.; loop 9, northward from Ventura station, 41 miles, 26-in.; loop 10, from the north end of a 26-mile gap beyond loop 9, where another loop will be built consisting of 39½ miles, 26-in.; total 111 miles, 24-in.; field office to be located at Ogden, Iowa, June 1; Boyd, spreadman.

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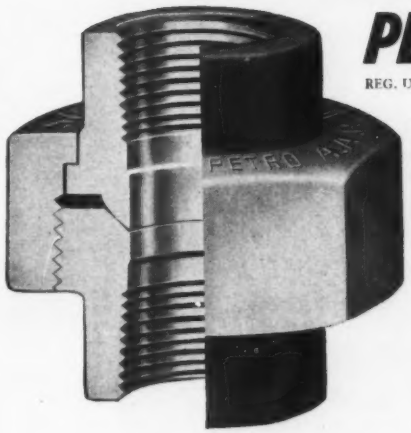

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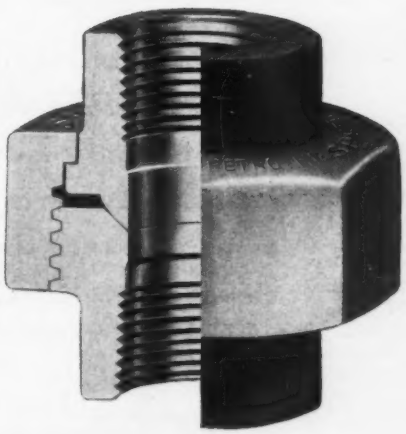

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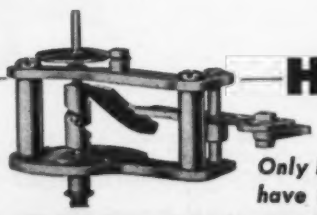

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Northwest Natural Gas Co.—750 miles, planned; Washington Oregon, and Idaho.

Pacific Gas & Electric Co.—506 miles, 34-in., under construction, Topock, Ariz.-Milpitas, Calif.; Bechtel-Price-Conyes, contractor; main-line office, Shafter, Calif.; R. L. Bowman, general superintendent.

Panhandle Eastern Pipe Line Co.—160 miles, additions to present system; approved. Also, 188 miles to be built in conjunction with the 160-mile project, along entire system. (Previously approved by FPC.)

69 miles 26-in. loops, Olpe to Hugoton, Kans.; Midwestern Constructors, Inc., contractor; office, Ottawa, Kans.; M. L. Wilhite, superintendent.

Panhandle Eastern Pipe Line Co.—358 miles, 26-in., authorized, looping in Texas, Oklahoma, Kansas, Missouri, Illinois, Indiana, Ohio, and Michigan.

75 miles, 26-30-in., loops in Illinois, Indiana, Missouri; Anderson Brothers Corp., contractor; field office, Rockville, Ill.; J. A. Brown, spreadman; office at Winchester, Mo.; Dewey Whitworth, spreadman. Under construction.

Peoples Gas Light & Coke Co.—Planned 42 miles, 24-in., Joliet-Chicago, Ill.

Phillips Petroleum Co.—25 miles gathering system in West Edmond, Okla., field; under construction; Vaughn & Taylor Construction Co., Inc., contractor; spread office Edmond, Okla.

118 miles, 3-to-20-in., gas-gathering system in Sherman and Hansford counties, Texas; Vaughn & Taylor Construction Co., Inc., contractor; D. D. Vaughn, spreadman; field office, Texhoma, Okla.

Phillips Petroleum Co.—118 miles 3-26-in., gas-gathering system, Sherman and Hansford counties, Texas; Vaughan & Taylor Construction Co., Inc., contractor; field office, Texhoma, Okla.; D. D. Vaughn and Jess Moore, spreadmen. Work 60 per cent complete.

Piedmont Natural Gas Corp.—1,350 miles, 20-in., planned, Greenville, Miss., to Norfolk, Va.

Plains Natural Gas Co.—78 miles, gathering system, Oklahoma-Kansas area, Hugoton field. Contracted by: Arey-Phillips Construction Co., Amarillo, Tex.; Tulsa Pipe Coating Co., Mid-Western Constructors, Inc., Engineering and supervision. Latter firm represented by Lyle DeWitt; field office, Liberal, Kans.

Roanoke Pipe Line Co.—30 miles 8-in., Gala, Va., to Roanoke, authorized.

South Jersey Gas Co.—77 miles, planned. Camden to Atlantic City.

Southern California Gas Co.—80 miles 30-in., Whitewater to Puente, Calif., under way; field office, Bonning, Calif.

Southern Natural Gas Co.—Following program approved by FPC (Docket G-1308): scheduled for 1950.—180 miles, 18-in., Gwinville, Miss., to Selma, Ala.; Sheehan Pipe Line Construction Co., contractor; 26 miles, 16-in., Selma to Marvin Gate, Ala.; 29 miles of 12-in., Carthage, Tex., to Logansport, La.; 14 miles, 14-in., Logansport to Perryville, La.; 5.8 miles of 8-in., Carthage field, Texas; 13.2 miles, 24-in., Benton-Pickens loop in Mississippi; 4 miles, 24-in., Coosa-Talladega loop, in Alabama; 4 miles, 24-in., Tallapoosa-Bowden loop in Alabama; 11 miles of 6-in., Vicksburg loop in Mississippi; 6.2 miles, 12-in., Macon line loop, in Georgia; and the following connecting lines: 5 miles, 8-in., Meridian, Miss.; 1 mile, 8-in., Demopolis, Ala.; 35 miles, 8-in., La Grange, Ga.; 6.3 miles, 6-in., Lanett, Ala.; 6.2 miles, 8-in., Mississippi Chemicals Co. plant; 22 miles, 8-in., Childersburg, Ala.; 2 miles, 6-in., Beaunit Mills; and 12.6 miles, 12-in., Yates plant.

Scheduled for 1951.—45.6 miles, 18-in., and 22.9 miles, 16in., Selma to Marvin Gate, Ala.; 98.1 miles, 16-in., Marvin Gate to Bolingbroke, Ala.; 105 miles, 10-in., Bolingbroke Gate to Augusta, Ga.; 19 miles, 8-in., Augusta to Aiken, S. C.; 27.2 miles, 14-in., and 36.9 miles, 14-in., Logansport to Perryville, La.; 21.4 miles, 24-in., Perryville-Pioneer loop in Louisiana; 14.4 miles, 24-in., Onward Big Sunflower loop, in Louisiana; and the following connecting lines: 18.8

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STEP 2

Remove Excess Dye

STEP 3

Apply Developer
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STEP 4

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Complete portability takes rigid inspection into the field for use by anyone without special training. Dy-Chek's low cost extends precise inspection to even the smallest companies. Ample supplies for inspecting large areas of metallic surface can easily be carried to any location. On the other hand, the simplicity of the process lends itself equally well to installation in a plant for production-line inspection.

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XUM

miles, 6-in., Grantville, Ga.; and 15.5 miles, 4-in., Sandersville, Ga.

Southern Union Gas Co.—78 miles, 8-10-14-in., planned, New Mexico loops and laterals.

Tennessee Gas Transmission Co.—65 miles, 16-in., planned, Ohio-Pittsburgh spur.

40 miles, 16-in., Beaver Falls-Pittsburgh, Pa., Britton Construction Co., contractor; office, Beaver Falls; Fred McKenzie, superintendent.

790 miles, 20-26-in., planned, Burnaugh, Ky., to Boston, including 400-mile line to Buffalo.

992 miles, 30-in., planned, first 150 miles of loops to be laid at Monroe, La., Greenville, Miss., Midland and Portland, Tenn.

385 miles 26-in., Greenup County, Kentucky, to New York; contracted to H. C. Price Co., Bartlesville, Okla.

Latex Construction Co. has following contracts: 123 miles, 30-in., West Monroe to Many, La., W. H. Hayes, superintendent, field office, Natchitoches, La.; 95 miles 20-in., Natchitoches to Kinder, La.; F. A. Silar, superintendent, W. A. Briley, assistant; field office, Natchitoches, La. 75 miles, 16-in., Kinder to Bayou Sale, La., F. A. Silar, superintendent.

54.2 miles, 30-in., under construction, White Bluff area to Joelton, Tenn., area, contracted to Morrison Construction Co.

36.1 miles, 30-in., under construction, Glasgow, Ky., area to Joelton area, contracted to Morrison Construction Co.

18.1 miles, 30-in., under construction Union City to Buckeye, Ky., Anderson Brothers Corp., contractors.

47 miles 30-in., Glasgow to Lebanon, Ky.; H. C. Price Co., contractor; field office, Scottsville, Ky.; R. L. McMillon, spreadman.

99 miles 30-in., under way, Dickson to Selmer, Tenn.; field office, Dickson, Tenn.; Jack Hodges, spreadman.

63 miles 26-in., Mahoning River near Youngstown, Ohio, southward; H. C. Price Co., contractor; G. A. Reutzel, supt.; field office, Columbiana, Ohio. 63 miles 26-in., Muskingum River northeastward; R. K. Shivel, supt.; office, Zanesville, Ohio; 47 miles 26-in., Muskingum River southwestward; W. B. Williams, supt.; office, McConnelsville, Ohio; 47 miles 26-in., Ohio River northeastward; C. R. Ice, supt.; office, Portsmouth, Ohio. (Balance of 373-mile Ohio River-Buffalo project to be started in August 1950.)

27.7 miles, 12-in., under construction, El Campo, Tex., to near Traitor, Tex.; Massey Construction Co., contractor.

25 miles, 30-in., Hardeman and McNairy counties, Tennessee; H. C. Price Co.; field office, Selmer, Tenn.; J. A. Reutzel, spreadman.

174 miles, 30-in. loops in western Tennessee and Kentucky; Price-Morrison, contractor; R. L. McMillon, spreadman; office, Scottsville, Ky.; Jack Hodges, spreadman; office, Dickson, Tenn.

103 miles 30 and 26-in. loops, Premont to El Campo, Tex.; Oklahoma Contracting Corp., contractor; M. E. Shiflett, supt.; Joe Freeman, paymaster. Work under way.

60 miles, 30-in., between stations 104 and 99; Anderson Brothers Corp.; field office, Richmond, Ky.; A. G. Hobson, spreadman. 65 miles, 26-in., Station 110 to Ohio River; field office, Moorehead, Ky.; E. C. McCoy, spreadman.

170 miles of 26 and 30-in., contracted by Anderson Brothers Corp., in Kentucky

91 miles 30-in., Holly Springs, Miss., south; contracted to Oklahoma Contracting Corp.; Raymond Law, supt.; Gene Gohring, paymaster; office, Holly Springs; work to begin June 1.

Texas-Eastern Transmission Corp.—1,400 miles planned, Texas to Pittsburgh loops.

108 miles 16-in., authorized, Provident City to Baytown, Tex.

Texas Gas Transmission Corp.—103 miles, 20-in., Carthage, Tex., to near Lisbon, La., (Sharon); under construction; N. A. Saigh Co., Inc., contractor; Carthage, Tex.; Bob Floyd, representative. Construction subcontracted: (1) Fowler Brothers, 43 miles from Carthage to Red River, field office at Carthage; M. C. Johnson, spreadman; (2) 63 miles to Sharon station, Oklahoma Contracting Co. (J. R. Horrigan) field office at Minden, La.; Ed Flanagan, spreadman.

32 miles, planned, Slaughters, Ky., to Evansville, Ind.

Texas Illinois Natural Gas Pipeline Co.—1,400 miles, 30-in., approved, La Gloria field, Texas, to Joliet, Ill. Contracted as follows: Midwestern Constructors, Inc., 292 miles 30-in., Cape Girardeau, Mo., to terminal points at Joliet and Volo, Ill.; and 100-mile section of 26-in. in Texas coastal plain. H. C. Price Co., 38 miles 12-in., 36 miles 24-in., 97 miles 26-in., 113 miles 30-in., all in coastal plain region of Texas; 126 miles 30-in., eastern Texas. Bechtel Corp., 420 miles 30-in., Arkansas and Missouri. Fish Pipeline Construction has contracts for compressor stations.

58-mile, 20-in. lateral, Joliet terminal to connection with Natural Gas Pipeline Co of America near Volo, Ill.

Trunkline Gas Co.—1,775 miles, 10-26-in., planned; includes 740-mile, 26-in. main line from Lake Charles, La., to Tuscola compressor station on Panhandle Eastern Pipe Line Co., (approved), and 1,035 miles, 10-24-in., Lake Charles, La., to McAllen, Tex., field lines, pending FPC approval of changed plans. Contracted as follows: Section A, main line, 176 miles 26-in., Longville to Darnell, La.; Houston Contracting Co.; Section I, lateral line, 33 miles 20-in., 18 miles 16-in., 8 miles 10-in., Longville, La., south; Houston Contracting Co.; Section B, main line, 180 miles 26-in., Darnell, La., to Senatobia, Miss.; Anderson Bros. Corp.; Sections G and H, lateral line: 217 miles 24-in., Longville, La., to Altair, Tex.; Anderson Bros. Corp.; Section C, main line: 184 miles 26-in., Senatobia, Miss., to Joppa, Ill.; R. H. Fulton & Co.; Section D, main line, 186 miles 26-in., Joppa to Tuscola, Ill.; Mahoney Contracting Co.

United Fuel Gas Co.—32 miles, 20-in., authorized; Roane, Calhoun, and Wetzel counties, West Virginia.

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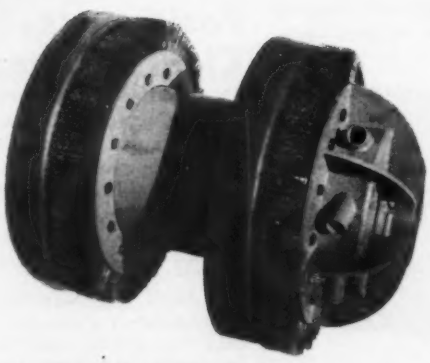
← 24" Size New Design TYPE GP PIGS with Brushes Mounted on Arched Springs to Compensate for Wear

30" Size → Standard Design TYPE RCN-50 with Jet Rotation Feature to Distribute Wear



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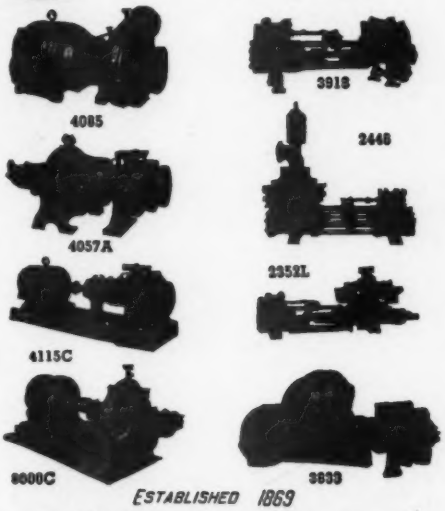

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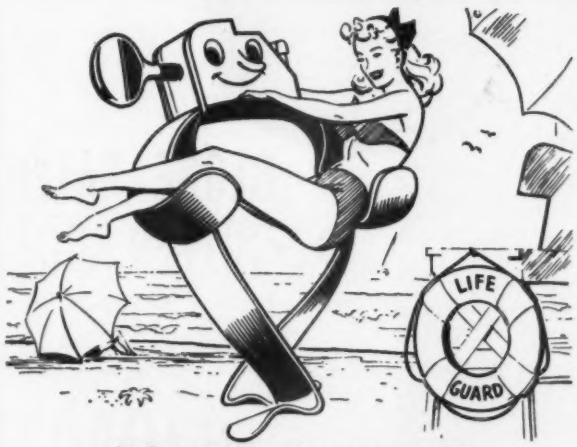

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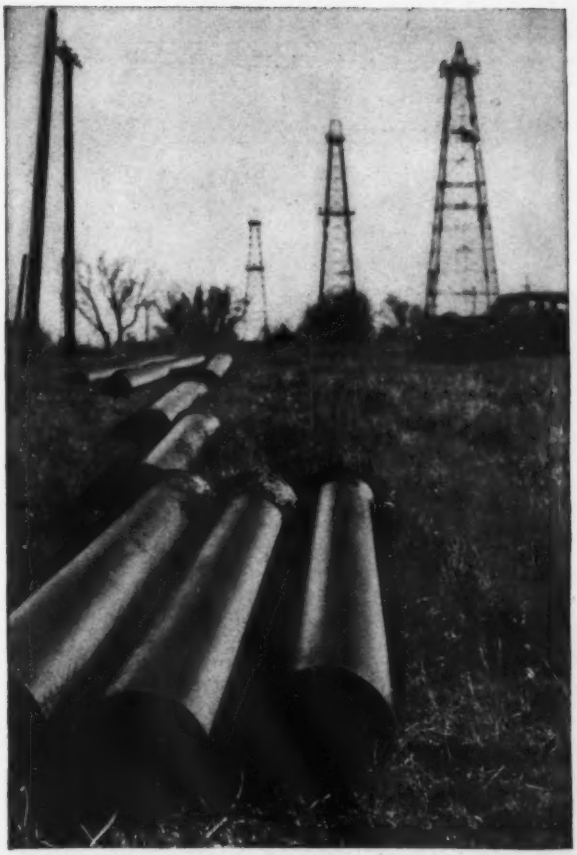

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Among the Drilling Contractors

Two Deep Wildcat Tests Being Started by Housh

Housh Drilling Co., Houston, has contracts for two more deep wildcat tests to be drilled on the Texas Gulf Coast for C. N. Housh, one of the principal owners of the drilling company, and American Republics Corp.

One is for a 12,000-ft. test, 1 Pearl Wooten, located in the James Haddon League, Colorado County. The location is about 5 miles south of the Columbus field.

The other is for a 10,000-ft. test, 1 Read, located in the William Phillips Survey, Tyler County.

Elk City Mud School

The Central Oklahoma chapter of the American Association of Oilwell Drilling Contractors is sponsoring a drilling mud school for oil-field workers in the Elk City area to be held September 11-22. Classes will be held in the city of Elk City. "Spider" Schults, Shell Oil Co., Elk City, is in charge of advance arrangements and registration.

Santa Maria Drilling Co., Long Beach, Calif., has been awarded the contract for another Union Oil Co. well in the East Coyote field, near Los Angeles. The new well will be 7 Sunny Hills. This contractor has just completed a west extension well in the Cat Canyon field of Coastal California for General Petroleum Corp.

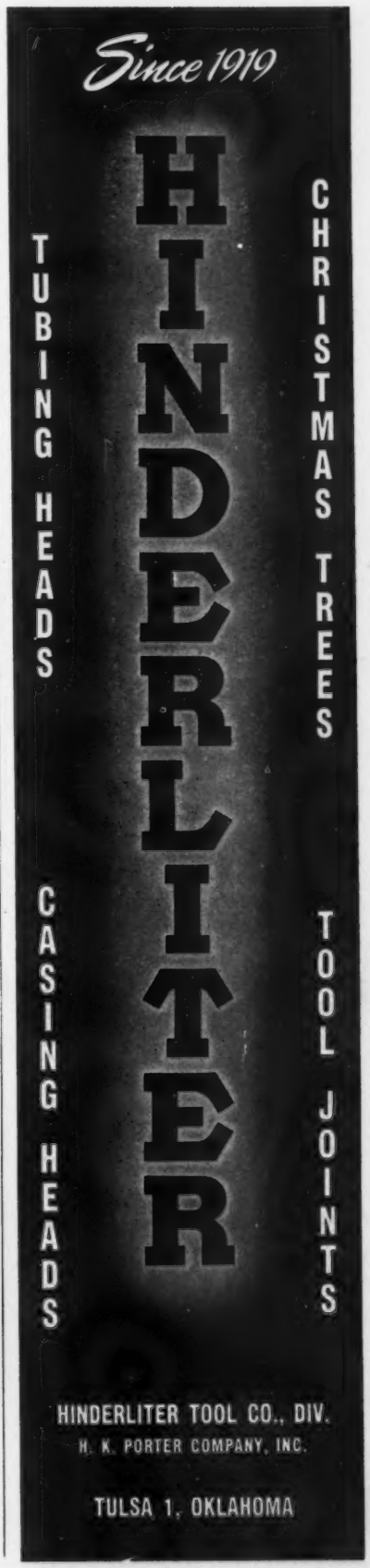
M. J. Delaney Drilling Co., Dallas, is starting Sanders and Murchison 2 Carroll, a projected 9,300-ft. test in the M. Rionda Survey, Tennessee Colony field, Anderson County, East Texas.

Birmingham-Bartlett Drilling Co., Wichita, is drilling for **Heathman Drilling Co.,** Wichita, at 1 Balls, NE NE NE 6-12-18, a mile south of the Riverview pool, Ellis County, Kansas.

Severns Drilling Co., Los Angeles, will drill Union Oil Co. 27-13 KCL, the latest test projected for the Gosford field, Kern County, California. It is drilling below 7,000 ft. on a Shell Oil Co. contract, 1 Coffin, in the Cantua Creek area, Fresno County, California.

Southeastern Drilling Co., which recently moved its headquarters from Jackson, Miss., to Dallas, has taken a wildcat acreage "farm-out" in Copiah County, Mississippi, from Superior Oil Co., and is starting a deep test for its own account. The acreage is in the area about 15 miles east of Hazelton with location for the test on the Southern Package Corp. fee land

Morris Palmer (extreme left), Tyler, Tex., drilling contractor, with his toolpusher, A. H. Crider, and members of his three crews gather around the engines of his new rig running in the Pine Mills area of Wood County, East Texas. Shown, in addition to Palmer and Crider, are: J. A. Poimbeauf, J. R. Thornton, and J. W. Thompson, drillers; J. Q. Wright, R. B. McClenny, and N. M. Poe, derrickmen; W. J. Stennett, W. A. Doyle, E. E. Doyle, J. D. Henry, J. D. Boyd, Hayley Holiday, and D. Charles, floormen; O. H. Hughey, truck foreman; Roland Hoffpaiur, welder; and "Cowboy" Hicks, tractor driver.



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in the NE NW 6-10n-6e. The test is projected to 10,300 ft.

M & M Drilling Co., Houston, has the contract to drill Superior Oil Co. 46 Schwing, a projected 3,500-ft. test in the Bayou Blue field, Iberville Parish, Coastal Louisiana. Location is in 74-9s-10e.

J. P. Owen Drilling Co., Overton, Tex., has a rig in the Big Island field, Rapides Parish, South Louisiana. Currently, the rig is making hole at 1 William Lucas Heirs, 42-5n-3e, a well being drilled for the contractor's own account.

Lohmann-Johnson Drilling Co., Inc., Great Bend, Kans., is starting two recently contracted wildcat tests, both in Kansas. One is for Atlantic Refining Co. at 1 Beitler, NE NW NE 27-22-8, in northern Reno County. The other is for G. M. R. Oil Co. at Stecklein, SW SW SW 34-11-18, northern Ellis County.

Dorris Ballew, Natchez, Miss., has moved a heavy rig to a location about 2½ miles south of Ludlow, Scott County, Mississippi, where he has a contract to drill a 9,500-ft. test for Clyde E. Moss and Frederic F. Mellon. The test is 1 Latham. Specific location is in the SW SW 21-8n-6e.

Armstrong & Sutton Drilling Co., San Antonio, has a rig running for its own account in the North Cistern area of Fayette County, Texas Gulf Coast. Present operation is 2 F. A. Kremel, Nellie B. League, M. Duncan Survey.

Gillespie & Sons, Cushing, Okla., got the contract for a wildcat test which Continental Oil Co. has projected for the area 3 miles east of White Eagle, in the extreme western part of Osage County, Oklahoma. The location, on the Niemann lease, is in the NE SW SW 24-25n-2e. It is about 6 miles south of Ponca City, in Kay County.

ROTARY RIGS IN OPERATION*

(United States and Western Canada)

Area—	Week ended 8-14-50	Change week ended 8-7-50	Change week ended 8-15-49
Gulf Coast	525	+27	+ 6
W. Tex. N. M.	746	0	+235
Ark.-N. La.-E. Tex.	153	— 4	— 15
Oklahoma	294	+44	+ 64
Kansas	120	— 1	+ 7
Illinois-Eastern	137	—16	+ 8
Rocky Mountains	107	— 5	— 2
Pacific Coast	138	—10	— 13
Total United States	2,220	+35	+290
Western Canada	105	+10	+ 19
Total	2,325	+45	+309

*Courtesy Hughes Tool Co. Trends in drilling activity in the United States and the Gulf Coast and Arkansas-North Louisiana-East Texas areas are shown by graphs on pages 218 and 219.

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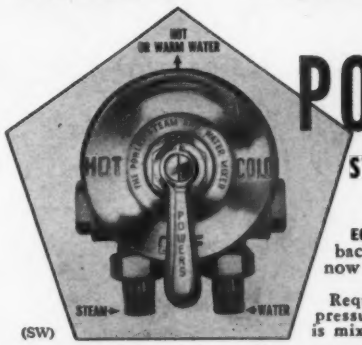

(SW)

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3. In all, over 5400 key personnel are listed in this directory, an average cost of $1.60 per 1000 names.

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REFINING

New Ethyl Plants

Antiknock-compound maker picks Houston

HOUSTON.—Ethyl Corp. has selected Houston as the site for new manufacturing plants to produce more than 100,000,000 lb. of chemicals annually, B. Bynum Turner, general manager of the company's manufacturing department, disclosed here last week.

The new plants, to be located on the Houston Ship Channel, will be integrated to manufacture all the tetraethyl lead, ethyl chloride, sodium, and chlorine used in the processes for producing antiknock compounds. Work on the project will begin immediately, and when completed by the end of next year, 750 workers will be employed.

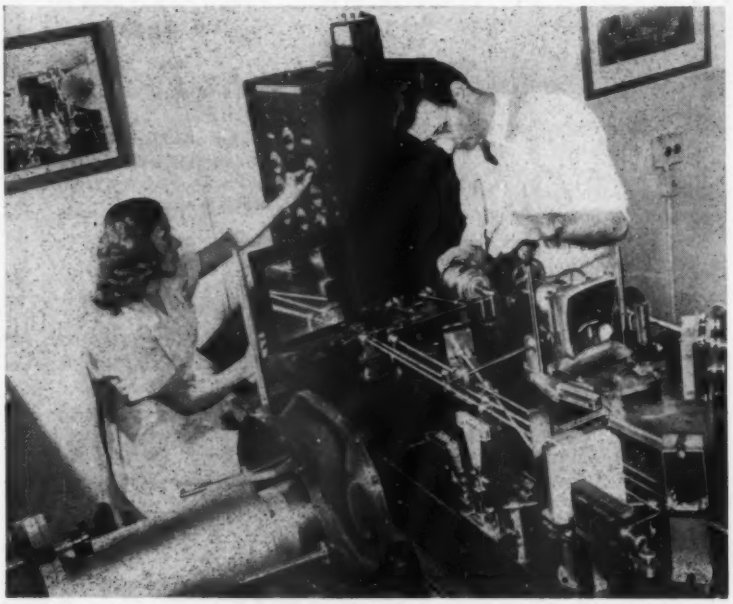
Among principal raw materials required to produce the compound are metallic lead, common salt, and petroleum gases. Principal manufacturing units of the new plants, Turner said, will include buildings for manufacture of tetraethyl lead, sodium-lead alloy, sodium and chlorine, and ethyl chloride. Auxiliary units will includ a blender where tetraethyl lead is mixed with ethylene dibromide and ethylene dichloride to produce the antiknock compounds; laboratories, storage tanks, offices, and other installations.

Centered in Louisiana.—Manufacturing facilities of Ethyl Corp. have previously been centered in Baton Rouge. The plant there has been continuously increased in capacity until it is now the largest chemical plant of its kind in the world. In addition to making antiknock compounds, the plant is the nation's largest producer of metallic sodium and ethyl chloride.

Lube Production Rises

TULSA.—Production of lubricating oils in the Mid-Continent area took another sharp increase in June, Western Petroleum Refiners Association announced recently. Shipments also rose sharply, compared with the same month last year.

Based on operations of 14 reporting companies, figures show that pro duction amounted to 1,567,208 bbl for June, an increase of 40.8 per cent



NEW USE OF SYNCHROS.—Moving the internal parts of an infrared spectrograph while they are in a high vacuum is a new use of synchros at The Texas Co.'s Beacon, N. Y., laboratories. This device, ordinarily used to indicate angular motion at a distance from the object which is moved, is believed to be the first application to initiate controlled motion in a vacuum. Spectrograph is used extensively to identify complex hydrocarbon mixtures. The synchros enable the operator to adjust prisms and mirrors while working parts are under high vacuum.

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or 454,677 bbl. over June 1949. Figures for June 1949 were based on 13 reporting firms, however.

Domestic shipments during the month totaled 1,678,385 bbl., a gain of 567,254 bbl., or 46.8 per cent over June last year. Export shipments were 80,850 bbl., up 61,755 bbl., or 212.5 per cent from June 1949.

Total shipments amounted to 1,759,235 bbl., up 55.5 per cent, or 628,109 bbl., from the same month last year. Stocks on hand at the end of June totaled 1,359,971 bbl. This is a decline of 281,402 bbl., or 17.1 per cent from that month in 1949. Days' supply on hand at the end of June was 61, compared with 118 last year at that time.

Start Lubrizol Plant

HOUSTON. — Petroleum additives will be manufactured in a new plant to be constructed immediately by Lubrizol Corp., Cleveland, Ohio. A 30-acre site east of the Shell Oil Co.'s Deepwater refinery has been purchased for the development costing $1,000,000.

The plant will manufacture chemical agents for addition to lubricating oils, using mostly raw materials found in the South Texas area.

Preliminary construction work has already been started by Brown & Root, Inc. Completion date is set for early next year.

Odorless Paint Solvent

To produce solvents for odorless paint, Shell Oil Co. has completed a specifically designed plant at the company's Wood River, Ill., refinery. Increased production is provided to meet the great demand for odorless paint in the painting of home and office interiors.

At present the new solvent is available only in tank-car quantities. However, the company will provide individual drums for testing purposes until arrangements can be made for tank-wagon and drum distribution through distributors.

Closed Refinery to Open

TEXAS CITY, Tex. — Crews have been hired to return the Sid Richardson refinery here into immediate production after having been closed for 14 months.

John Allen, plant superintendent, reported the refinery held a contract for war materials and that 175 former employes had been recalled. Several months will be needed to condition the plant for operation.

Pickets of the Building and Trades Council A. F. of L., are stationed at refinery gates. The union claims the company has violated a contract by hiring laborers from West Texas. The union further maintains that former employes should be rehired on a seniority basis.

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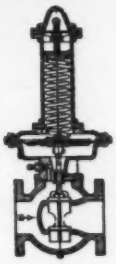

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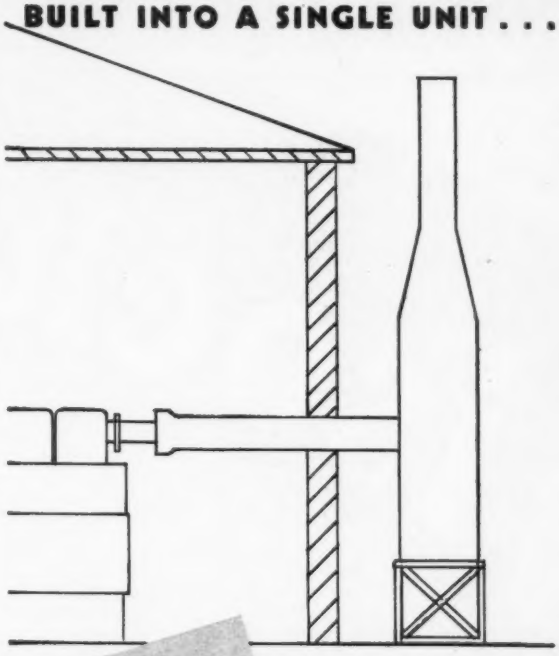

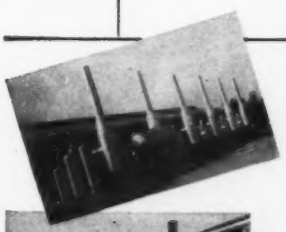

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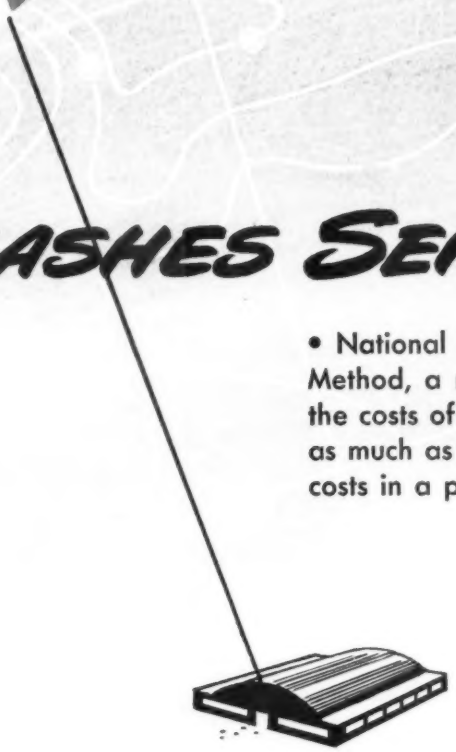

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Exploration and Drilling

Canada's Viking Sand Gets Recognition

CANADIAN oil men are now recognizing the Viking sand of Alberta and southern Saskatchewan as being a worthy objective in their search for oil. Recent discoveries and the development of Joseph Lake pool indicate that the Viking sand is destined to play an important, though not spectacular, role in western Canada's rapidly expanding oil industry.

When Joseph Lake, the first oil pool in the Viking sand, was discovered a year ago last March, little interest was aroused. The discoveries of Leduc-Woodbend, Redwater, Golden Spike, and Stettler with their tremendous thicknesses of oil-bearing Devonian dolomites, were still too fresh, and development in these pools was far too active for much interest to be directed toward a well that was producing from a gun-perforated interval of only 1 ft. opposite a sand with a 7-ft. oil zone of doubtful areal extent.

The picture has changed. There haven't been any strikes so far this year that have been proven to be of major size. Joseph Lake has grown into a sizable oil pool, and reports of oil in the Viking sand are popping up over quite an area. Near Bulwark, about 95 miles southeast of Joseph Lake, the second Viking-sand oil pool for Alberta has been opened recently, and what appears to be the third Viking oil discovery is now being completed 70 miles northwest of Joseph Lake, near Lisbon. In addition, drill-stem tests of wells in North Woodbend and Excelsior have recently had shows of oil from the Viking.

The Viking sand and its equivalent or near-equivalent sandstone members of the Colorado (Alberta) shales, found in the basal portion of the Upper Cretaceous sediments, are present over most of Alberta, and in the southern half of Saskatchewan. These sands have been producing gas in fields of the foothills belt, the Sweetgrass arch region, and the eastern homoclinal belt for many years, but, until the discovery of Joseph Lake pool, had never yielded oil in commercial quantities.

The first Viking - sand - equivalent gas pool found in the eastern homoclinal belt (the structural province of current Viking sand oil interest) was Pelican, which was opened in 1897. The large Viking-Kinsella gas area of East Central Alberta, now estimated to contain a trillion cubic feet of dry gas, was discovered in 1914; and the Kinsella portion, first drilled in 1929, is still being developed.

Joseph Lake, 50-22w4, is the largest light (38° gravity) crude pool producing from a sand in Alberta. There are 12 producers in this pool with 28 locations considered proven by the operators of the 10,630-acre unitized block in which five companies have interests. The trapping structure appears to be an irregular anticlinal nose of slight relief on a regional monocline. The Viking sand, found around 3,300-ft. depth, is shown by cores to be coarse grained, clean, very permeable (in some samples up to 4,000 md.), and highly porous (up to 25 per cent). Variable water levels indicate that the sand is lenticular.

The maximum development of sand above water level found to date is 28 ft. The best oil wells have had 10 ft. of gas, which is cased through, and 18 ft. of oil column. Drill-stem tests indicate that these wells have influx rates up to 1,000 bbl. daily. The pool will have a strong water drive. The discovery well and its three offsets in the northwestern portion of the pool are producing some water. The other eight wells, drilled in an area south and east of the discovery well, are water free. Three of these wells penetrated the full Viking sand. One well found water at the base of the sand, but the other two, though drilled deeper than the determined water level in the northwestern wells, had no sign of formational water.

The proved oil reserves at Joseph Lake are estimated to be around 7,500,000 bbl. by the operators' engineering consultants. About one-third of the estimated ultimate recovery is already developed. If future drilling continues to fit the seismic picture of the trap, which indicates favorable structural conditions to the south, the proved reserve estimate will be increased. Accumulated production for the pool is nearing 100,000 bbl. with current "allowable" (market quota) set at 50 bbl. per day per well. There are two rigs operating in the pool.

Philip C. Ingalls.

HIGHLIGHTS OF WEEK'S DEVELOPMENTS

SOUTHWEST TEXAS.—Five sands have been found in the newly discovered Triple A field of San Patricio County. (See field report on this area this week.)

ROCKY MOUNTAIN AREA.—Stanolind Oil & Gas Co. is coring in Dakota sand, with that formation hard and tight, at its Ignacio, San Juan Basin, Colorado, test. In New Mexico, Thomas Doswell et al. are preparing to test gas shows in Morrison at the South Governador area wildcat. Deep Rock Oil Co. found oil in its northeast extension test to Huntsman pool, Nebraska. In northeastern Colorado, Shell Oil Co. has announced its first Denver-Julesburg Basin wildcat.

WEST TEXAS.—Terry County had its fourth Pennsylvanian discovery at Union Oil Co. 1 Laura A. Cotton, 91-T-D&W, 4 miles southeast of Brownfield. Top of the Pennsylvanian, tentatively identified as reef, was 9,902 ft., and minus 6,640 ft. First production was found at 9,950-70 ft., and the well developed flowing production on all succeeding tests to 10,002 ft., and cored additional saturation to 10,033 ft. Location is 11 miles southwest of Mound Lake field, first Pennsylvanian pool in the county, 9 miles northeast of 1 Bevers, second discovery, and 10 miles northwest of Amerada's 1 Willard, discovery prospect not yet completed.

XUM

Southwest Texas

Triple A Field Has Five Pays

CORPUS CHRISTI.—Triple A field of San Patricio County is being developed into a major oil producing area by J. S. & R. H. Abercrombie and Atlantic Refining Co., discoverers of the new field. The operators' 1 L. E. Fite, Robert Saddler Survey, was completed to flow 145 bbl. of 46°-gravity oil daily through a 9/64-in. choke through perforations at 7,148-50 ft. The 1 Nelson, discovery well, was completed as an oiler through perforations at 6,666 ft., after shows of gas and condensate were found from 7,280-85 ft. The operators' third well, 1 Ola McCann, Juan Garcia Survey, is testing gas and condensate from 8,870-76 ft., a fourth producing zone for the field, and operators will test a fifth sand at 8,800 ft.

Humble Oil & Refining Co. has completed its 4 Robert J. Kleberg, Jr., Trust-Viboras Pasture, as an oil discovery for Viboras field, Brooks County. On potential gage, the well was credited with 105 bbl. of 44.2°-gravity oil per day through ⅛-in. choke. The hole is bottomed at 9,003 ft., and production is through perforations at 7,578-86 ft. The operators' 2 Robert J. Kleberg, Jr., Trust, field discovery, is a gas well.

In Webb County, O. W. Killam 2 Floyd Billings, wildcat in CCSD&RGNG Survey 39, 16 miles north of Bruni, promises to open a new area. On drill-stem test at 2,380½-98 ft., ¼-in. chokes, the well recovered 83 ft. of pipe-line oil and 10 ft. of mud, and developed 45 psi. pressure. On 1-hour drill-stem test at 2,398-405 ft., recovery was 380 ft. of pipe-line oil. The well is at a total depth of 2,405 ft.

J. C. McCabe 1 Mayflower Investment Co., wildcat in I&GN Survey 677, Abstract 459, 7 miles northwest of Carizo Springs, Dimmit County, is coring below 2,800 ft. after recovering oil on two drill-stem tests. A test at 3,114-32 ft. recovered 20 ft. of oil, and one at 2,164-75 ft. recovered 60 ft. of oil-cut mud.

SOUTHWEST TEXAS (DISTRICTS 1 AND 4) SUCCESSFUL WILDCATS

Brooks County: Oil discovery in Viboras—Humble Oil & Refining Co. 4 Robert J. Kleberg, Jr., Trustee-Viboras Pastures, TMRR Sur., TD 9,008 ft., perf. 7,578-86 ft., 105 bbl. oil per day, ⅛-in. choke, TP 700-900 psi., 44.2° gravity.

New pay at Mariposa—Frank W. Michaux and Sterling Oil & Refining Co. 1 D. J. Sullivan, Loma Blanca Grant, TD 9,003 ft., perf. 6,543-52 ft., 9,900,000 cu. ft. of gas per day, open flow, SIP 2,410 psi.

San Patricio County: New pay at West Sinton, Shallow—Payne & Riggs 6 J. G. Moss, John Pollan League, TD 2,406 ft., perf. 2,039-43 ft., 114 bbl. oil per day, 10/64-in. choke, TP 140 psi., CP 200 psi., 21° gravity.

SOUTHWEST TEXAS (DISTRICTS 1 AND 4) WILDCAT FAILURES

Caldwell County: Weigand Bros. Drilling Co. 1 H. L. Sinclair, H&TC RR Co. Sur. 3, 8½ mi. E of Luling, dry, TD 3,970 ft.

Duval County: John F. Camp & Sons et al 1 E. J. Miller et al, Diego Ynojosa Grant, 4 mi. NW Realitos, dry, TD 3,146 ft.

Russell Maguire C-1 Driscoll, Sweden Farmlot Subd., Santa Rosalia Grant, 18 mi. W Benavides, dry, TD 3,920 ft.

Hidalgo County: D. J. Schwartz 1 Elton B. Smith, Block 26, Capisallo Dist. Subd., 2⅛ mi. NE Mercedes, dry, TD 8,020 ft.

Texas Co. 1 Snitily Gah unit, Gregorio Camacho Sur. 68, A-28, dry, TD 8,600 ft.

Jim Hogg County: Pontiac Refining Co. 2 Y. Vela Cuellar, W. M. Clay Sur. 576, A-162, 18 mi. S Hebbronville, dry, TD 1,780 ft.

Kenedy County: J. S. Abercrombie Co. 1 Isabel Y. Garcia, San Juan de Carricitos Grant, 11½ mi. N Raymondville, dry, TD 10,559 ft.

Medina County: Ralph E. Fair, Inc. 2 G. C. McAnelly, Edmund C. Durst Sur. 13, dry, TD 439 ft.

Nueces County: Chicago Corp. and Nueve Oil Co. 1 Sam C. Lewis, Geo. H. Paul Subd., Driscoll Ranch, dry, TD 8,508 ft.

San Patricio County: S. H. Howell 2 Katherine Clifton, Victoria Juarez Sur., 2 mi. S Tynan, dry, TD 4,819 ft.

Skelly Oil Co. 1 H. A. Adams, Sec. 40, George H. Paul Subd., 4½ mi. N Edroy, dry, TD 6,252 ft.

Webb County: Bridwell Oil Co. 1 A. M. Bruni, Brown Subd., Albercas Grant, 12 mi. S SE Mirando City, dry, TD 2,650 ft.

Kansas

Eastern Barton County Adds Another Oil Pool

A NEW oil pool for eastern Barton County is in prospect where Alpine Oil & Royalty Co. is testing Arbuckle lime in its 1 Hartman, SE SE NE 28-19-11. After drilling plug and acidizing with 500 gal., the hole filled 2,000 ft. with oil overnight. At latest report, swab was being run but no estimate or gage of production was given. Pay zone was topped at 3,340 ft. (—1,559 ft.). Total depth is 3,350 ft., with 4½-in. casing at 3,342 ft. The location is about 2 miles northwest of nearest production in the Silica field and about the same distance southeast of the Kowalski pool.

Petroleum, Inc., 1 Hall, SE SE SW 7-21-13, prospective discovery well in the gap between the Dell pool, about a mile to the north, and the North Pundsack pool, about the same distance to the south, swabbed at the rate of 4½ bbl. of oil per hour in starting production tests of Arbuckle lime, topped at 3,635 ft. (—1,718 ft.). Hole is open from 3,636 to total depth of 3,640 ft. Formation has not been acidized.

Peel & Harman and associates got some free oil and about 20 ft. of oil-cut mud in a drill-stem test of Arbuckle lime in their 1 Calhoun, NE NE SE 18-8-21,a wildcat located more than 5 miles north of nearest production on the west side of the Morel pool, southeastern Graham County. The test took in an interval at 3,593-97 ft., with top of the Arbuckle at 3,592 ft. (—1,526 ft.). Casing has been run to 3,593 ft.

C-G Drilling Co. and D. G. Hansen 1 DeYoung, SW SW SW 35-9-21, 2 miles south of the Morel pool, same county, has been completed as a maximum well (draw-down potential 3,000 bbl. per day) to establish another pool for the area. Production is from Arbuckle, topped at 3,826 ft. (—1,550 ft.). Total depth is 3,839 ft. with 5-in. casing at 3,827 ft.

KANSAS SUCCESSFUL WILDCATS

Rooks County: Barnett 1 Hinkhouse, SE SE SE 9-10s-20w, pumped 166 bbl. of oil per day from Arbuckle at 3,722-25 ft., TD 3,730 ft., anhydrite 1,630 ft., Heebner 3,395 ft., Lansing-Kansas City 3,434 ft.

Russell County: Lewis 1 Streck, SW NE NW 26-13s-14w, elev. 1,832 ft., pumped 240 bbl. of oil per day from Arbuckle at 3,272-75 ft., TD; anhydrite 830 ft., Topeka 2,698 ft.

Stafford County: Huber-Pabco 1 Kachelman, SE SE SW 7-25s-13w, elev. 1,962 ft., 106 bbl. of oil per day from Viola at 4,075-86 ft., TD; Heebner 3,530 ft., lime 3,665 ft., Lansing-Kansas City 3,677 ft., basal Kansas City 3,961 ft., Marmaton 4,006 ft., Viola 4,056 ft.

KANSAS WILDCAT FAILURES

Barber County: Beardman et al 1 Benefield, SW NW NW 2-32s-12w, elev. 1,517 ft., dry, TD 4,771 ft., Elgin 3,371 ft., Douglas 3,657 ft., Lansing-Kansas City 3,680 ft., Mississippi lime 4,285 ft., Viola 4,532 ft., Simpson 4,619 ft., Arbuckle 4,718 ft.

Barton County: Musgrove 1 Nelson, SE SE SW 16-20s-13w, elev. 1,879 ft. DF and 1,877 ft. Gr., dry, TD 3,575 ft., anhydrite 736 ft., Topeka 2,816 ft., Heebner 3,124 ft., lime 3,241 ft., Lansing-Kansas City 3,254 ft., Sooy 3,483 ft., Arbuckle 3,532 ft.

Alpine 1 Boor, NW NW NE 14-17s-12w, elev. 1,872 ft. DF and 1,870 ft. Gr., dry, TD 3,385 ft., anhydrite 745 ft., Heebner 2,967 ft., Dodge 2,972 ft., lime 3,064 ft., Lansing-Kansas City 3,081 ft., Sooy 3,338 ft., Arbuckle 3,353 ft.

Butler County: Sace Oil Co. et al 1 Kassebaum, CWL SW SE 12-26s-5e, elev. 1,334 ft. DF and 1,332 ft. Gr., dry, TD 2,766 ft., Lansing 1,842 ft., Kansas City 2,137 ft., Bartlesville 2,640 ft., Mississippi lime 2,755 ft.

Ellis County: Jones-Shelburne & Farmer 1 Foster, NW NW NW 26-15s-16w, elev. 1,811 ft. DF and 1,809 ft. Gr., dry, TD 3,397 ft., Heebner 3,054 ft., Toronto 3,073 ft., Lansing-Kansas City 3,108 ft., Sooy 3,358 ft., Arbuckle 3,390 ft.

Amerada 1 Leikam, NE NW NW 35-12s-17w, elev. 2,119 ft., dry, TD 3,698 ft., anhydrite 1,298 ft., Heebner 3,335 ft., Lansing-Kansas City 3,382 ft., Sooy 3,640 ft., Simpson 3,648 ft., Arbuckle 3,653 ft.

Ellsworth County: National Assoc. 1 Oeser, SW SW NW 21-15s-10w, elev. 1,801 ft. DF and 1,799 ft. Gr., dry, TD 3,421 ft., Topeka 2,528 ft., Heebner 2,861 ft., Toronto 2,882 ft., lime 2,930 ft., Sooy 3,298 ft., Simpson sand 3,340 ft., Arbuckle 3,349 ft.

Harp 1 Muncie, SE SE NW 33-15s-8w, elev. 1,551 ft. DF and 1,548 ft. Gr., dry, TD 2,659 ft., Heebner 2,398 ft., lime 2,519 ft., Lansing-Kansas City 2,535 ft.

Graham County: Cook & Galloway 1 McPherson, NE NE SE 4-9s-23w, elev. 2,237 ft. DF and 2,234 ft. Gr., dry, TD 4,095 ft., anhydrite 1,889 ft., Heebner 3,513 ft., Toronto 3,535 ft., Lansing-Kansas City 3,559 ft., basal Kansas City 3,793 ft., Sooy 3,999 ft., Arbuckle 4,066 ft.

Francis 1 Hinkhouse, NW NW SW 11-10s-22w, dry, TD 4,030 ft., anhydrite 1,775 ft., Heebner 3,503 ft., Toronto 3,524 ft., Lansing-Kansas City 3,539 ft., cherty Sooy 3,850 ft., Arbuckle 4,014 ft.

Kingman County: Smitherman 1 Seifert, NE NE NE 12-28s-5w, elev. 1,407 ft. DF and 1,405 ft. Gr., dry, TD 3,832 ft., lime 2,935 ft., Lansing-Kansas City 2,960 ft., Mississippi chert 3,744 ft., dolomite 3,778 ft.

Lyon County: Lance Hill 1 Dickason, SW NW NW 16-20s-12e, elev. 1,176 (?) ft., dry, TD 1,295 ft., Kansas City 1,210 ft.

Morris County: Alexander-Richards-Wakefield 1 White, NW NW SE 36-15s-8e, elev. 1,387 (?) ft., dry, TD 3,361 ft., Lansing 1,603 ft., Kansas City 1,730 ft., Mississippi lime 2,522 ft., Kinderhook 2,802 ft., Hunton 2,939 ft., Viola 3,142 ft., Simpson 3,278 ft., Arbuckle 3,324 ft.

Rooks County: Heathman 2 Teall, NW NW NE 17-10s-20w, elev. 2,254 ft. DF and 2,252 ft. Gr., dry, TD 3,875 ft., anhydrite 1,741 ft., Topeka 3,293 ft., Heebner 3,498 ft., Lansing-Kansas City 3,538 ft., Sooy 3,808 ft., Simpson 3,835 ft., Arbuckle 3,850 ft.

Stafford County: Sterling-Davis-Child 2 Kisner, SW SW SE 3-22s-13w, elev. 1,893 ft. DF and 1,891 ft. Gr., dry, TD 3,825 ft., anhydrite 745 ft., Heebner 3,237 ft., lime 3,371 ft., Lansing-Kansas City 3,390 ft., Sooy 3,672 ft., Simpson 3,742 ft., Arbuckle 3,802 ft.

Gabbert-Jones 1 Newcomb, NE NE NW 5-21s-13w, elev. 1,897 ft., Df and 1,894 ft. Gr., dry, TD 3,621 ft., anhydrite 810 ft., Heebner 3,174 ft., lime 3,288 ft., Lansing-Kansas City 3,299 ft., cherty Sooy 3,558 ft., Simpson 3,576 ft., Arbuckle 3,586 ft.

Anschutz 1 Carr, NW NW NE 19-22s-14w, elev. 1,962 ft. DF and 1,960 ft. Gr., dry, TD 4,033 ft., anhydrite 890 ft., Heebner 3,392 ft., lime 3,516 ft., Lansing-Kansas City 3,532 ft., Sooy 3,803 ft., Viola 3,862 ft., Simpson 3,946 (?) ft., Arbuckle 3,996 ft.

Texas Gulf Coast

Hardin County Gets New Pool

HOUSTON.—Another new oil pool is being opened in Hardin County at Sohio Petroleum Co. B-1 Nona Mills, wildcat 5 miles southwest of the Kountze townsite, WCRR Co. Survey 355, Abstract 519. On a drill-stem test through perforations at 7,646-52 ft., using 8/64-in. choke, the well flowed 5 bbl. of oil per hour, being 95 per cent oil and 5 per cent wash water. Gravity of the oil was 32.6°. Tubing pressure was 825 psi. The well was drilled to a depth of 9,212 ft.

Final completion has been made on a new pool opener at Gulf South Oil Corp. 1 Niebuhr, Dorsett Survey, Jackson County. The well gaged 81 bbl. of 33.8°-gravity oil daily through a 7/64-in. choke, through perforations at 5,736-40 ft. Tubing pressure was 690 psi. and casing pressure 1,075 psi. The hole was drilled to a depth of 6,215 ft. and operators set 5½-in. casing at 5,900 ft. This well is located approximately 1 mile northeast of Little Kentucky field.

Sun Oil Co. has opened new pay in Midfields field at 2 St. Louis Brownsville Corp., which flowed 223 bbl. of 42.6°-gravity oil per day through 8/64-in. choke on 24-hour potential test. The well was drilled to a depth of 11,106 ft. and operators perforated the interval 10,446-52 ft. for completion. Production is in the lower Frio, deeper than any other previous production in the field. Location is in the I&GN RR Co. Survey, Section 2.

Union Oil Co. of California has commenced testing operations on its 1 D. P. Moore estate, wildcat in the North Lucky area of Matagorda County. On drill-stem test through perforations at 10,464-66 ft., the well tested salt water and gas. Perforations were squeezed and operator is preparing to reperforate for another test.

TEXAS GULF COAST (DISTRICTS 2 AND 3) SUCCESSFUL WILDCATS

Liberty County: New pay at South Liberty—L. M. Josey et al 3 Trinity River Bed-State, M. G. White League, 2 mi. S Liberty, TD 7,717 ft., Cook Mountain sand, perf. 7,200-384 ft., 240 bbl. oil per day, 12/64-in. choke, TP 1,500 psi., 36.5° gravity.

Matagorda County: Sun Oil Co. 2 St. Louis Brownsville Corp., I&GN RR Co. Sur. 2, TD 11,106 ft., perf. 10,446-52 ft., 223 bbl. per day, 8/64-in. choke, TP 2,800 psi., 42.6° gravity.

Orange County: Wayside Oil Co.-Paul Cormier 1 Gulf's Lee Hager fee, S. M. Luce Sur., A-252, TD 6,319 ft., perf. 5,160-64 ft., 127 bbl. oil per day, 3/16-in. choke, TP 1.875 psi., 34.4° gravity.

TEXAS GULF COAST (DISTRICTS 2 AND 3) WILDCAT FAILURES

Bee County: Curtis Singleton Drilling Co. 1 H. D. Hughes, C. Rivas Sur., A-280, 8 mi. W Beeville, dry, TD 5,418 ft.

Jackson County: Ley C. Moore 1 J. E. Davis et al, W. J. E. Heard Sur., A-31, 4 mi. SW Ganado, dry, TD 6,620 ft.

Karnes County: H. R. Smith-W. C. McBride, Inc. and Danciger Oil & Refining Co. 1 Charlie Moczygemba, Fernando Carillo Sur., 5 mi. NE Falls City field, dry, TD 6,225 ft.

Lavaca County: Sterling Oil & Refining Co. 1 Emma Borchers, James Chesher Sur., A-113, 18 mi. N Edna, dry, TD 9,506 ft.

Liberty County: L. M. Josey et al 1 E. W. Pickett, M. G. White Sur., A-117, dry, TD 3,740 ft.

Live Oak County: Chamberlain, Fisher & Presnall 1 Brennan est., Maria Brennan Sur., A-3, 2 mi. SE Mikeska, dry, TD 5,300 ft.

Chicago Corp. and Nueve Oil Co. 4 J. I. Hailey, P. Miller Sur., A-277, dry, TD 4,870 ft.

Montgomery County: Johnny Mitchell 1 First National Bank of Galveston, Wil-

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800 Travis St., Ph.: ATwood 6441

Santa Fe

liam White Sur., 8 mi. NE Huffsmith, dry, TD 6,011 ft.

Tyler County: American Republics Corp. and Houston Oil Co. 1 Mary Lee Hosford et al, BBB&C Sec. 17, A-49, 3 mi. S Spurger, dry, TD 8,012 ft.

Wharton County: T. H. Abell et al 2 Gulf Sulphur Co., S. F. Austin League, A-2, Boling Dome, dry, TD 1,498 ft.

Commercial Petroleum & Transport Co. 1 Blanche Vitera, William White Sur., A-644, 4 mi. N Louise, dry, TD 5,636 ft.

Wilson County: Rock Hill Oil Co. 1 Arthur Ridout, John W. Brown Sur., 5 mi. E Floresville, dry, TD 2,811 ft.

Michigan

Kalkaska Wildcat Continues Testing

MOUNT PLEASANT.—Neil Wagenaar and Edward Wagner were testing at their 1 Marshall, SE SW SE 11-27n-6w, Excelsior Township wildcat, Kalkaska County, which was reported to be flowing from 17-25 bbl. of oil an hour from a top Traverse pay the first few hours after acid treatment.

The Traverse top was logged at 2,004 ft., hole bottomed out at 2,009 ft., and oil and gas showing from 2,006 ft. to the total depth. The well carried a hole full of oil, natural, with one or more small flows reported. The zone was acidized with 750 gal. Further testing of this top Traverse pay may be necessary before any evaluation of this wildcat's immediate significance can be made. However, some geologists were considering this well's showing as one of the most significant this year, lending possibility of opening a rank new area in northern Michigan for exploration and development.

In Garfield Township, Bay County, E. V. Hilliard was testing a Dundee oil show in his 1 Bay Trust & Castle, NW NW NW 23-16n-3e, a wildcat test located about 8 miles northwest of the large Kawkawlin Dundee oil pool. The operator logged Dundee top at 3,199 ft. Pays were drilled at 3,280-94 ft. and 3,301 ft. The well was drilled to 3,354 ft., total depth, and carried about 250 ft of oil in 16 hours and 400 ft. in 36 hours. A long string of 5-in. casing was being run in preparation for acid treatment. Both the oil and the pay level in the Dundee appeared to be quite similar in characteristics with those found in Kawkawlin field.

I. W. Hartman's 1 Manley, SE NE SE 33-17n-7w, Orient Township oil discovery, Osceola County, was flowing at a restricted rate of 5 bbl. an hour after a 200-gal. acid treatment of 2,000 ft. of free showing natural in the Dundee. It flowed at the rate of 25 bbl. an hour after swabbing had cleaned the hole of acid load. The operator estimated that the 1 Manley would flow from 30-40 bbl. an hour unrestricted. The Dundee was logged at 3,788 ft. and hole is bottomed out at 3,792 ft. This wildcat is located about 1½ miles northeast of Fork Dundee oil pool, Mecosta County.

MICHIGAN WILDCAT FAILURES

Bay County, Gibson Township: Walhalla Oil Co. 1 Barbour-Hawkins et al, NE SE NW 26-18n-3e, Dundee 2,838 ft., dry, TD 3,104 ft.

Mecosta County, Aetna Township: W. H. Strickler 1 Hoerner, C SE 5-13n-10w, Stray 1,184 ft., dry, TD 1,199 ft.

Green Township: Union Development Co. 1 Hurst, NW NE SW 17-16n-10w, Dundee 3,470 ft., dry, TD 3,710 ft.

Oceana County, Golden Township: R. W. Devine & J. W. Lang Co. 1 Wheeler, SW SW NW 13-15n-18w, Dundee 2,212 ft., dry, TD 2,313 ft.

Shelby Township: Mercer Oil Co., Inc. 1 Morse, NW NW SE 15-14n-17w, Dundee 2,503 ft., dry, TD 2,621 ft.

Van Buren County, Pine Grove Township: Jack Lipps & Nick Dodd 1 Opas, SW NE SE 3-1s-13w, Traverse 1,386 ft., dry, TD 1,389 ft.

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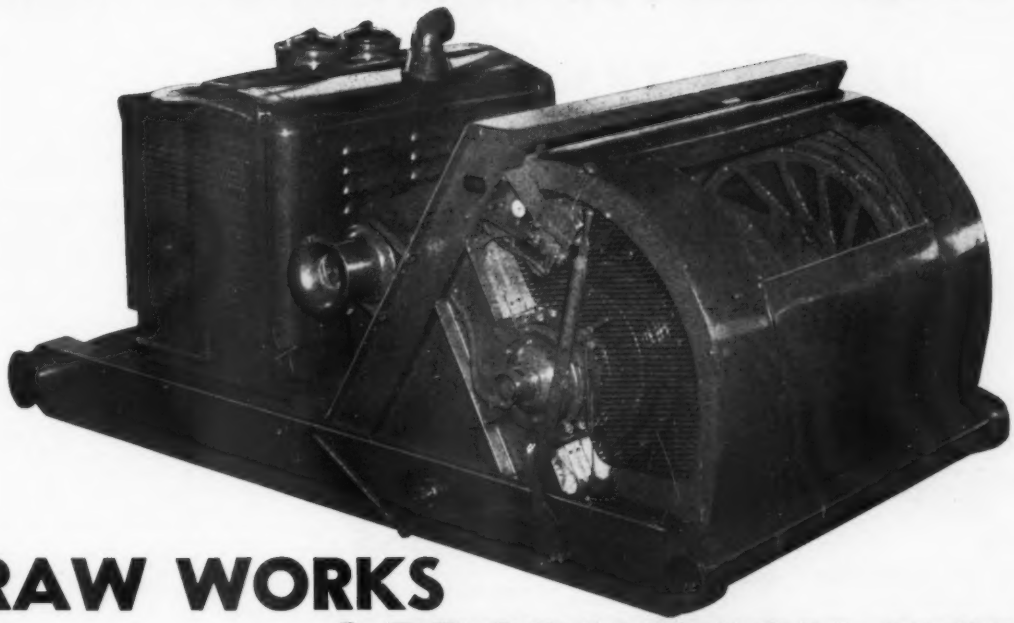

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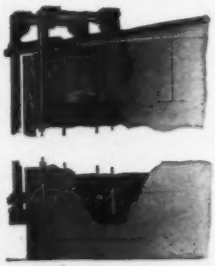

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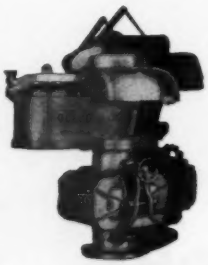

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California

Development Accelerating In New Kern County Pool

LOS ANGELES.—Development of the new field opened by Shell Oil Co. in the Antelope Hills area of Kern County is getting under way after a 2-months delay. The pool was opened early in June when Shell 63X-23, a core hole converted to the status of a regular wildcat, was completed for 500 bbl. daily of 15.7°-gravity crude from a sand at 2,365 ft. Site of the wildcat was in NE Section 23-27s-19e. Following the discovery Shell drilled additional core holes in the area but no offsets were staked until 2 weeks ago.

At a northwest stepout, Shell 52X-23 Hopkins fee, hole has been carried to 2,025 ft. To the southeast of the discovery the company has staked location for a second test, its 74X-23 Hopkins fee. Some ¾ mile to the northwest of the discovery, in SW Section 14, Tide Water Associated Oil Co. has staked location for a third test, its 25-14 fee.

About 3 miles to the southeast, in Section 1-28s-19e, Shell has plugged back its 82-1 Williams from 3,500 ft. to 2,740 ft. On a 1-hour formation test at 2,695-2,740 ft. water and drilling mud was recovered. A second test up the hole, from 2,450-2,510 ft., resulted in a gas flow estimated at 1,000,000 cu. ft. daily and a recovery of 600 ft. of gassy, muddy water.

Three potential discoveries, two of which already have showed for 500-bbl. producers on drill-stem tests, were in various stages of work at the weekend. In northwestern Cuyama, after being cored to a total depth of 6,235 ft., Hancock Oil Co. 44-31 Bishop was plugged back to 6,020 ft. with a perforated liner set at 5,785 ft. to plugged-back depth. An almost assured new discovery, its completion is being held up a few days while storage tanks are erected.

In the Castaic area of northern Los Angeles County, Texas Co. has bottomed its 1 Honor Farm at 6,038 ft. with 7-in. casing set at 5,280 ft. On a drill-stem test at 5,313-33 ft. earlier in August, the wildcat showed for a 500-bbl. producer. Tankage likewise was being built at this probable discovery and the outcome should be known within a few days.

After two disappointing tests in lower sections, General Petroleum Corp. was preparing for a third formation test in the 441-14 Boston Land Co. in the Huron area of Fresno County. With hole plugged back from an original depth of 13,621 ft. to 13,250 ft., the second test was at 13,214-16 ft. After the tool was open 3 hours and 20 minutes there was a 5,400-ft. rise in the pipe. Showings of oil and gas were present in the upper portion of the recovery, with the balance being water.

Among the several new wildcats staked during the week was a 3,000-ft. test to be drilled in Tehama County's Hooker Dome area. Located in Section 12-28s-4w, the test will be C. L. Fowler and W. Hunt 1 Cassidy. In Kern County, Shell has staked location for its 86-X Michelson fee about ¾ mile west of South Belridge production. In the Hanford area of Kings County, Goshen Syndicate has staked location for a southeast offset to its recent discovery, 2 Drummond - Union. Santa Barbara County received a new wildcat, Standard of California staking a location on the Hollister estate in the Gaviota area. There six tests have found varying quantities of oil and gas but all were non-commercial. Two miles southeast of Edison field in Kern County, San Joaquin Drilling Co. has staked its 1 Di Giorgio in Section 31-30s-30e.

CALIFORNIA UNSUCCESSFUL WILDCATS

Fresno County, Cantua Creek-Turk Anticline area: Russell Giffin 33-17 S.P., 17-17s-15e, dry, TD 9,900 ft., elev. 421 ft.

Cantua Creek area: Shell Oil Co. 1 Webb, 24-15s-14e, dry, TD 7,407 ft., elev. 210 ft.

Coalinga, West area: JNJ Corp. 1 Webb, 12-21s-14e, dry, TD 500 ft., elev. 1,154 ft.

Kern County, Tejon Hills area: Star Oil Co. 6 Tejon, 2-11n-18w, dry, TD 503 ft., elev. 1,207 ft.

Los Angeles County, Del Valle area: Ohio Oil Co. 1 Mabel S. Henderson, 10-4n-17w, dry, TD 5,875 ft., elev. 1,180 ft.

Monterey County, Los Lobos area: Texas Co. 1 Garrissere, 32-22s-10e, dry, TD 4,532 ft., elev. 733 ft.

San Benito County, Lewis Creek area: North American Oil Cons. 1-11 U.S.L. 11-19s-10e, dry, TD 5,969 ft., elev. 2,050 ft.

San Benito area: San Benito Oil Co. 1 Ley, 31-17s-10e, dry, TD 3,371 ft., elev. 2,050 ft.

San Luis Obispo County, Paso Robles area: Fairview Exploration Co. 1 Fairview-Paso Robles, 22-26s-12e, dry, TD 4,370 ft., elev. 775 ft.

Solano County, Goodyear area: George T. Cameron 1 Griffon 16-3n-2w, dry, TD 3,208 ft., elev. 13 ft.

Mississippi

Adams County Wildcat Tests Below 6,400 Ft.

JACKSON.—Danciger Oil & Refining Co. and William Helis are still testing their Adams County wildcat, 2 George Armstrong, 3 miles north of Ellisile field and 2 miles northeast of Sibley field, after failing to establish production in the Barksdale zone of the Wilcox. Drill-stem test in the Parker zone, which carried good shows at 6,343-48 ft., recovered only salt water. Operators perforated the section at 6,436-44 ft., using ¼-in. top and ½-in. bottom chokes and 540 ft. of water cushion. Top surface pressure reached 26 psi. in 20 minutes and then dropped to zero. Swabbing operations were begun and recovery was only water cushion, rat-hole mud and water. Operators have squeezed these perforations and will continue to test.

In Pickens field, Yazoo County, Carter Oil Co. is at 7,765 ft. in its 1 Wilson-Wilburn Unit, 30-12n-3e, which is believed to be 15 ft. above the lower Cretaceous zone from which production was found in the company's discovery, the 1 Wilson. Several cores have been taken with no shows. Drill-stem test was run at 7,590-653 ft. which recovered salt water and muddy water. No electric log has been run in the well, but samples, cores, and drilling time indicate that the test is approximately 70 ft. higher structurally than the discovery well.

Continental Oil Co. has revealed plans for a deep Smackover test approximately 7 miles northwest of Canton in Madison County. No exact spotting of the test has been announced, but it is believed it will be in 26-10n-1e. In Flora field of Madison County, Gulf Refining Co. is drilling below 7,756 ft. in its 1 J. R. Anderson, 2-8n-1w. A third Smackover venture in this general area is Lion Oil Co. 1 Denkman, 22-7n-4e, in northern Rankin County. Operators are now moving in derrick to begin operations.

In Stone County, Mississippi, George Vasen is coring at 17,920 ft. in his 1 fee, 9-2s-11w.

In Tennessee, Whitney, Nance & Vivadelli 1 Donaldson, SE SW NW 10-16s-8e, Hardeman County, is drilling in brown sandy lime. Depth was reported as 2,370 ft. The well is located 1 mile southwest of Hornsby.

MISSISSIPPI WILDCAT FAILURES

Jefferson County: Petersen Drilling Co.-Global Trading Co. 1 J. Fred Gordon, 32-9n-1w, dry, TD 5,904 ft.

Lee County: J. F. Michael 1 Temple-Harmon unit, 8-11s-7e, dry, TD 1,761 ft.

FLORIDA WILDCAT FAILURE

John S. Neilson-W. E. Walker 1 McDavid, Inc., 35-6n-30w, dry, TD 6,598 ft.

Rocky Mountain

San Juan Basin Tests Watched With Interest

DENVER.—Two important Dakota tests are near completion in the San Juan Basin of southwestern Colorado and northwestern New Mexico. Stanolind Oil & Gas Co. is coring in the Dakota at 1 Ute Indian, C SE NE 18-33n-7w, wildcat at Ignacio, LaPlatte County, Colorado. The well is now below 7,410 ft., 150 ft. in the Dakota and that formation has been hard and quartzitic. Shows of oil have been found only in slight fractures. A drill-stem test in Dakota showed only a slight amount of mud. This well is based on a large seismic high just across the state line in Colorado and northeast of Barker Creek gas field. Stanolind found gas in the Fruitland and Pictured Cliffs sands, and is believed to have a commercial gas discovery in these zones. Failure in the Dakota is a disappointment for this area.

South of Kutz Canyon in the South Governador area, Thomas Doswell et al are now testing shows of gas found in 1 Scott-Federal, C NE NW 10-26n-6w, Rio Arriba County. This well is at 7,562 ft., total depth, with Dakota topped at 7,200 ft. and Morrison at 7,470 ft. The operator has moved in cable tools and drilled plug after cementing casing on top of the Dakota. Some gas has been found in the wildcat and this will be tested.

Deep Rock Oil Co. has found production in the Huntsman area, Cheyenne County, Nebraska, making the third operator with production in that area. Deep Rock's farmout from Frontier Refining Co. of Denver is located ½ mile northeast of production in Huntsman pool. The well, 1 Siemers, SW SW NW 6-14n-49w, filled 3,900 ft. with oil and 600 ft. of water on 30-minute drill-stem test in the "J" sand between 4,815-30 ft. It is 65 ft. lower structurally than any other well in the area, and the recovery of oil on tests of this sand indicate a larger productive area for this field than expected.

Shell Oil Co.'s first wildcat in the Denver-Julesburg Basin area, following an extensive lease and geophysical play, will be in the Buckingham area, Weld County, Colorado. The well is 1 Hanson, NE NE NE 33-8n-59w, and will be a test through the Dakota series to around 7,000 ft. Shell has a block of approximately 5,000 acres in this area and has done seismic work on the block. Continental Oil Co., Ramsey Petroleum Co., Fred M. Manning, Inc., and others have drilled Dakota tests on this structure, each of which found shows of oil and gas. Shell farmed out in a part of its acreage in Perkins County, Nebraska, to H. C. Arnold of Tulsa, who will start a well through Dakota sands on this block in the near future.

WYOMING WILDCAT FAILURES

Como Ridge, Albany County: Smith Drilling Co. 1 Boylan, NE SE SW 34-23n-77w, TD 210 ft., dry, Tensleep 192 ft.

Lightning Flat, Crook County: Amerada Petroleum Corp. 2 Robert Ormesher, NW SE NW 35-58n-68w, TD 3,394 ft., dry, Frontier 2,112 ft., Mowry 3,093 ft., Newcastle 3,289 ft., base Newcastle 3,395 ft., Dakota 3,605 ft.

WYOMING SUCCESSFUL WILDCATS

Sussex, Johnson County: Continental Oil Co. 27 Unit, NW NE SE 18-24n-78w, TD 4,454 ft., swabbed 85 bbl. oil in 8 hours, estimated pumping potential 250 bbl. per day, 7-in. csg. 4,414 ft., w/300 sx., Sussex 3,950 ft., Shannon 4,412 ft.

South Lodgepole, Weston County: Schlaikier Bros. and South Lodgepole Development Co. 1 Steele, NE NW SW 16-43n-65w, TD 6,168 ft., flowed 40 bbl. oil per day, 5½ in. csg. 6,144 ft., Niobrara 4,695 ft., Wall Creek 5,032 ft., Newcastle 6,121

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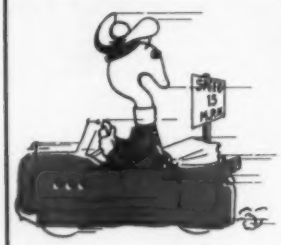

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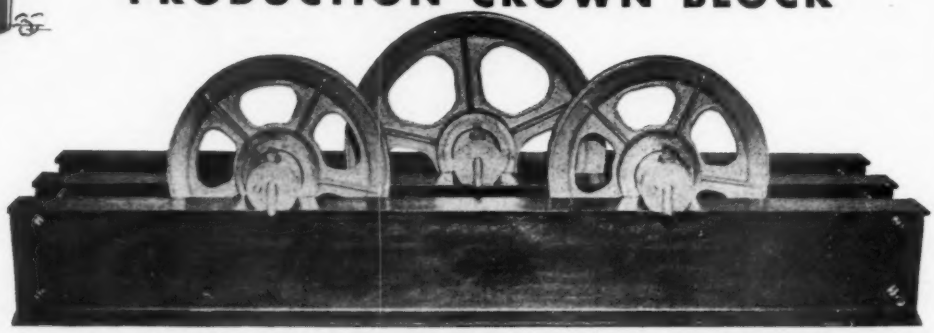

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COLORADO SUCCESSFUL WILDCAT

Merino, Logan County: Trigood Oil-Ohio Oil 1 Couch, SE SE SE 19-6n-54w, TD 5,391 ft., PB 5,160 ft., pumped 280 bbl. fluid per day, 12 per cent water, 7-in. csg. 5,160 ft., Niobrara 4,142 ft., Ft. Hays 4,452 ft., Greenhorn 4,678 ft., first Dakota 4,973 ft., second Dakota 5,058 ft., Lakota 5,256 ft., perf. 5,095-5,112 ft., 4 holes per ft.

MONTANA WILDCAT FAILURES

Wayne Creek, Blaine County: Fair & Woodward 1 H. Miller, C NE SE 3-32n-24e, TD 4,410 ft., dry, Ellis-Madison 4,306 ft.

Sage Creek Structure, Carbon County: Electron Oil & Gas Co. 1 Govt., C SW SE 31-7s-24e, TD 1,680 ft., dry, Lakota 1,593 ft.

Winifred area, Fergus County: Alpha Petroleum Co. 1 Hawkins, NW NW NE 6-21n-18e, TD 2,605 ft., dry.

Delphia area, Musselshell County: Texas Pacific Coal & Oil 1 State "B," C SW SW 29-10n-28e, TD 5,370 ft., dry, Eagle 952 ft., Mosby 1,920 ft., first Cat Creek 2,950 ft., Kootenai 3,053 ft., Morrison 3,372 ft., Ellis 3,580 ft., Amsden 3,920 ft., Otter 4,225 ft., Kibbey 4,480 ft., Charles 4,670 ft.. Madison 5,300 ft.

NEBRASKA WILDCAT FAILURES

Imperial, Chase County: National Associated Petroleum Co. 1 McFaddin, SW SE SE 10-46n-38w, TD 3,105 ft., dry, Pierre 300 ft., Niobrara 1,663 ft., Carlyle 2,178 ft., Greenhorn 2,367 ft., Graneros 2,480 ft., upper Muddy 2,498 ft. "D" sand 2,568 ft., "M" sand 3,986 ft.

Airport area, Cheyenne County: Edward Pace-Ohio Oil Co. 1 Airport, NW NE NW 18-13n-49w, TD 5,180 ft., dry, Niobrara 3,993 ft., Ft. Hays 4,271 ft., Codell 4,358 ft., Greenhorn 4,528 ft., first Dakota 4,784 ft., second Dakota 4,857 ft., third Dakota 4,907 ft., first Lakota 5,100 ft., second Lakota 5,152 ft.

Appalachian Field

Third Exploration Well Started in Maryland

PITTSBURGH. — Operations have been started in a deep wildcat test in Garrett County, Maryland. Columbian Carbon Co.'s 1-1502 N. K. Welch is currently drilling at a depth of 248 ft. It is on the Oakland Quadrangle 2.4 miles south of Lat. 39°, 25′, and 3 miles west of Long. 79°, 20′. Two other wells in the same county remain shut down: Eberly & Snee 1 G. H. Blocher at 5,136 ft., and Fox & Trimble 1 Edward Kite at 5,019 ft.

West Virginia.—In Steele district, Wood County, Columbian Carbon Co. 1-GW-1148 Godfrey L. Cabot, Inc. (Milton McLane Tract), was completed gaging 7,715,000 cu. ft. of gas, natural. Total depth was 5,024 ft. (See wildcat completion paragraph below). In Portland district, Preston County, Eberly & Snee have made location in the Terra Alta section for the 1 J. Paul Martin, elevation 2,024 ft. It is on the Kingwood Quadrangle, 4.9 miles south of Lat. 39°, 30′, and 4.2 miles west of Long. 79°, 30′. Hope Natural Gas Co.'s 9414 Chas. V. Ringer, elevation 2,194 ft., went back into the chert at 5,675 ft. The first section was at 5,487 ft. A second section of the Oriskany sand was reached at 5,884 ft. and additional gas was struck at 5,885 ft. All gas tests approximate 233,000 cu. ft. Drilling is at 5,895 ft. W. E. Snee 3 Cora E. Lewis, elevation 2,089 ft., recorded the Tully lime at 4,596-4,617 ft., again at 4,675-90 ft., and is drilling at 4,861 ft. In Dry Fork district, Tucker County, Cumberland & Allegheny Gas Co. 1-A-425 Jason Harman, elevation 3,304 ft., is shut down at 9,085 ft. and is running 2-in. tubing to acidize. Two Oriskany sand sections were recorded: 8,413-8,561 ft. and 8,575-8,630 ft. At 8,630 ft. a lime formation was recorded.

In Unity Township, Westmoreland County, southwestern Pennsylvania, Peoples Natural Gas Co. 1-3921 Fred Musnug, elevation 2,100 ft., is drilling at 4,775 ft. In Napier Township, Bedford County, South Penn et al, Snee & Eberly 1 Jesse B. Miller, elevation 1,666 ft., is drilling at 7,430 ft.

WEST VIRGINIA SUCCESSFUL WILDCAT

Wood County, Steele district: Columbian Carbon Co. 1-GW-1148 Godfrey L. Cabot, Inc. (Milton McLane Tract), elev. 788 ft., 7,715,000 cu. ft. of gas, natural, rock pressure 1,025 psi. in 42 hours, Corniferous lime 4,912 ft., Oriskany sand 5,015 ft., gas 5,017-24 ft., TD 5,024 ft.

Oklahoma

Third Oil Reservoir Proved at Ringwood

OFFICIAL confirmation has been made of the discovery of a third oil reservoir—the lower Manning sand (Mississippian) — in the fast-expanding Ringwood field, Major County. Mazda Oil Corp 1 Harman Heirs, NE NW NW 16-21n-10w, swabbed and flowed approximately 100 bbl. of oil in 18 hours after treatment with 15,000 gal. of acid through casing perforations at 7,052-7,110 ft. in that zone, topped at 7,052 ft. (—5,818 ft.). Total depth is 7,131 ft. (driller's log) with 7-in. casing cemented at 7,130 ft.

The well, however, was not completed in the new reservoir. Following the above test, plug was set at 6,988 ft. and casing perforated at 6,858-6,978 ft. in the upper Manning zone, the field's main producing reservoir. After acid treatment with 25,000 gal., the well flowed 210 bbl. of oil in 24 hours through 13/64-in. choke. Flowing pressures were 700 psi. on the tubing and 1,000 psi. on the casing.

Although the lower Manning sand is exposed in producing perforations in Tide Water Associated Oil Co. 1 Loomis, NE NE SE 5-21n-10w, 1½ miles to the north, the separate production test on this reservoir in the Mazda well marks the first released gage of productivity of the new pay. The Tide Water well is perforated in both the upper and lower Manning zones and produces from both together. It was the Tide Water well which recently went on record as the discovery well of the Maramec sand in the field, having tested and proved the productivity of that deeper zone before being completed in the Manning zones.

Strong gas showings have been encountered by Ohio Oil Co. in its 1 Jones, SE SE NW 35-3n-11e, deep wildcat test southwest of the shallow Ashland gas field, southeast of Parker, in northeastern Coal County. Showings were in a sandy dolomite zone in the Bromide, topped at 8,930 ft. In a 35-minute drill-stem test at 8,840-9,000 ft., the well flowed at an estimated rate of 3,000,000 cu. ft. of gas per day. Bottom-hole flowing pressure was 2,350 ft. With the well shut in, pressure built up to 3,250 psi. within 10 minutes. Hole was deepened to 9,042 ft. and a second drill-stem test made, taking in an interval from 8,960 ft. to bottom. In this test, with tool open 46 minutes, gas flow was gaged at the rate of 4,121,000 cu. ft. per day through ½-in. top and bottom chokes. Bottom-hole pressure during the test was 2,625 psi. Shut-in pressure built up to 4,075 psi. in 10 minutes. Hole is being cored ahead with diamond bit.

Shell Oil Co. 1 Neustadt, NE NW SW 29-3s-3w, deep zone discovery well located ¾ mile north of shallow production in the old Healdton pool, Carter County, flowed 109 bbl. of clean oil in 24 hours through tubing in testing sand, in which casing was perforated at 6,720-56 ft. Production the next 24 hours dropped to 99½ bbl. Gas-oil ratio was 3,750 cu. ft. per barrel. Total depth is 7,668 ft. with 5½-in. casing at 7,660 ft. Prior to present tests, which follow a succession of tests in lower zones, hole was plugged back to 6,900 ft. The location is about a mile southwest of the one-well Whiskey Creek pool, opened last year by Shell Oil Co. 1 Bristow, C SW SE 20-3s-3w, completed in a sand at 9,056-9,100 ft.

Deep Rock Oil Corp. has a new wet-gas discovery well at its 1 Eckles, NE SW NW 12-7n-11e, east of the Lamar townsite, Hughes County. Production was gaged at 7,750,000 cu. ft. of gas per day from casing perforations in Jefferson sand (lower Cromwell) at 3,905-28 ft. It is 5 miles from nearest production, the one-well Northwest Scipio gas-distillate pool.

OKLAHOMA SUCCESSFUL WILDCATS

Cotton County: Nixon Petroleum et al 1 Poolaw, NE SE NE 29-5s-12w, elev. 1,145 ft., pumped 1¼ bbl. of 40°-gravity oil per day from second Thomas sand at 1,687-1,718 ft., TD 1,853 ft., fusilinid lime 1,615 ft., first Thomas sand 1,646 ft.

Hughes County: Burma Petroleum 1 Butts, NE NE SW 13-7n-9e, 1½ mi. S Grief Creek, flowed 12 bbl. of 28°-gravity oil per day from Booch at 2,758-68 ft., TD 3,459 ft., lower Calvin 1,055 ft., lower Booch 2,998 ft., Hart 3,018 ft., Gilcrease 3,300 ft., Gilcrease sand 3,372 ft., old well worked over.

Major County: Mazda Oil 1 Harman, NE NW NW 16-21n-10w, 1¾ mi. S extension to Ringwood, also new pay (first to prove lower Manning but this zone not being produced), elev. 1,231 ft., flowed 147 bbl. of 40°-gravity oil per day from Manning at 6,858-6,978 ft., TD 7,131 ft., Layton 5,805 ft., Oswego 6,410 ft., Cherokee 6,582 ft., upper Manning 6,796 ft., middle Manning 6,858 ft., lower Manning 7,052 ft.

Pottawatomie County: Smith and Texas Co. 1 Badger, NE NE SW 21-10n-2e, new pay in Union Point, pumped 15 bbl. of 41°-gravity oil per day from dolomite at 5,892-99 ft., TD 5,960 ft., Viola 5,800 ft., Wilcox 5,956 ft., old well worked over.

Stephens County: W. L. Miller 2 Hefner, SE SW SE 11-2n-5w, new pay in SE Knox, pumped 20 bbl. of 37°-gravity oil per day from sand at 2,528-38 ft., TD 3,051 ft.

OKLAHOMA WILDCAT FAILURES

Comanche County: C. A. Anderson 1 Brindle, NE NE NE 15-1n-11w, 1 mi. SW Lawton, dry, TD 600 ft.

Dewey County: Stanolind and Magnolia 1 Harper, C W/2 NE NE 21-19n-18e, 55 mi. N-NE Elk City, est. elev. 1,930 ft., dry, TD 10,295 ft., Chase lime 3,490 ft., Tonkawa sand 6,549 ft., Tonkawa lime 6,6101 ft., Perry 6,955 ft., Layton 7,532 ft., Des Moines 7,746 ft., Peru 8,108 ft., Oswego 8,160 ft., Verdigris 8,527 ft., Bartlesville 7,822 ft., sand 9,587 ft., Springer sand 9,594 ft., basal Pennsylvanian-Chester 9,666 ft.

Grant County: T. G. Wylie 1 Young, C SE SE 18-27n-5w, 11 mi. NW Rich Valley, elev. 1,080 ft., dry, TD 5,794 ft., Tonkawa 3,680 ft., Layton 4,120 ft., Big lime 4,390 ft., Oswego 4,490 ft., Bartlesville 4,819 ft., Mississippi lime 4,939 ft., Woodford 5,534 ft., dolomite 5,601 ft., Wilcox 5,630 ft., second Wilcox 5,665 ft., Tyner 5,710 ft.

Hughes County: Diamond & Nye 1 Throckmorton, SW SW NE 19-8n-12e, 1¾ mi. N Lamar, elev. 772 ft., dry, TD 3,941 ft., Earlsboro 980 ft., Bartlesville 1,450 ft., upper Booch 2,050 ft., lower Booch 2,202 ft., Hart 2,384 ft., Gilcrease 2,682 ft., Gilcrease sand 2,772 ft., lower Gilcrease 2,960 ft., Wapanucka 3,448 ft., Union Valley-Cromwell 3,680 ft.

Jefferson County: L. S. Dennis 1 Reagan, SE SW SE 26-6s-5w, elev. 854 ft., dry, TD 2,959 ft., Permian-Hoxbar unconformity 1,085 ft., Palo Pinto lime 1,622 ft., first sand 2,215 ft., second sand 2,591 ft., crystalline detrital 2,711 ft., Arbuckle 2,936 ft.

Kiowa County: Can-Lew Oil Co. 2 Herrington, NE NE NW 32-7n-17w, dry, TD 1,032 ft., basal Permian 713 ft., granite wash 924 ft., chert 1,028 ft.

Okmulgee County: C. C. Rowden and R. C. Vincent 1 Mount, SE SE NW 7-13n-11e,

XUM

⅝ mi. NW of NW Gypsy Hills, elev. 709 ft., dry, TD 3,300 ft., sand 2,053 ft., Dutcher 2,520 ft., Wapanucka 2,574 ft., Viola 3,222 ft., dolomite 3,258 ft., Wilcox 3,264 ft.

Osage County: A. G. Oliphant 1 Osage, NW NW NE 6-25n-6e, 1¼ mi. NW of production W of Burbank, elev. 1,031 ft., dry, TD 2,990 ft., Mississippi chat 2,959 ft., Mississippi lime 2,964 ft.

Pawnee County: Curtis Oil Co. 1 Dunn, SW SW SW 17-20n-9e, ⅝ mi. NW of N Mannford gas production, dry, TD 2,430 ft., Layton sand 1165 ft., sandy shale 2,405 ft., conglomerate 1,547 ft., Red Fork 2,372 ft., Bartlesville 2,415 ft.

Payne County: T. N. Berry 1 Johnson, NE NW SE 34-18n-6e, geological atst in SE Schlegel, elev. 877 ft., dry, TD 3,620 ft., Hogshooter 1,811 ft., Layton 1,868 ft., Skinner 2,920 ft., Mississippi lime 3,292 ft., Woodford 3,470 ft., Viola 3,507 ft., Wilcox 3,552 ft., second Wilcox 3,572 ft.

Pontotoc County: W. H. Pine 1 Haynes, NE NE SW 16-5n-4e, dry, TD 3,106 ft., Hunton 2,506 ft., no Woodford, Sylvan 2,795 ft., Viola 2,912 ft.

Canadian Fields

Natural Gas Tapped Near Golden Spike

CALGARY.—A natural gas discovery was recorded at the Okalta-British Dominion 1 wildcat, about 3 miles northwest of current limits of Golden Spike D3 coral reef oil field. The well is a joint operation of four Calgary independents. The gas, at the rate of 2,000,000 cu. ft. daily, came in near top of the D1 zone of Devonian. Drilling is proceeding in search of the major objectives, the D2 and D3 zones.

Located in LSD 12, 9-52-27w4, the well reached D1 at 4,605 ft. A 1-hour drill-stem test was run of the interval 4,627-55 ft., and the above gas flow was recorded. Pipe recovery was 60 ft. of mud.

Naco, Ltd., brought in a natural gas discovery at its Drumheller wildcat during drill-stem test runs in the basal Cretaceous. During later tests, in the Madison limestone, the wildcat also gave shows of oil.

The well, Naco-Drumheller 1, in LSD 3, 34-29-19w4, is located about 68 miles northeast of Calgary and 6 miles northeast of Drumheller. Naco reported that a 1-hour test from 4,207-70 ft. gave a natural gas flow rate of between 9,500,000 to 10,500,000 cu. ft. daily. A more recent test, in the Madison at 4,305 ft. gave a pipe recovery consisting of 24 ft. of mud and approximately 39 ft. of oil. Drilling is now proceeding at 4,594 ft., continuing as a test down D3 Devonian equivalent.

A wet gas discovery has been made at Cessford 1 well, testing a seismograph-indicated feature about 15 miles northwest of Cessford town, and 95 miles east of Calgary. Discovery has been made in basal Cretaceous sands, between 3,393-3,418 ft.

Although full details of drill-stem tests run at the well have not as yet been released, best of three tests run gave a natural gas flow of over 5,000,000 cu. ft. daily rate over a 2-hour run, plus a spray of light oil. Five feet of light crude was recovered in the pipe, with no sign of water. Middle part of the zone, on drill-stem test, gave about 3,300,000 cu. ft. of gas daily rate, plus a pipe recovery of 2-3 gal. of condensate. Top of the zone showed around 850,000 cu. ft. of gas daily. The Cessford well, located in LSD 2, 32-25-13w4, is currently at 3,451 ft.

Twenty-three additional wells were completed in Alberta, to boost the province's total number of completions since the beginning of this year to 565 wells. There were 13 new oil producers, 2 gas wells, and 8 dry holes. Cumulative figures include 423 oil wells, 24 gas wells, and 118 failures.

UNSUCCESSFUL WILDCATS

Hanna Pete 5, LSD 11, 5-32-15w4, TD 3,949 ft.

Amerada Crown DF 1-13, LSD 13, 13-51-3w5, 3,590 ft.

Globe-Stettler West 1, LSD 8, 17-39-20w4, TD 5,400 ft.

Socony-Texaco-Sunnybrook 1, LSD 15, 11-49-2w5, TD 7,425 ft.

Shaw Whitemud 1, LSD 10, 15-51-25w4, TD 4,082 ft.

Cal-Standard Vegreville 1, LSD 2, 35-52-14w4, TD 3,337 ft.

South Louisiana

Shell Brings in New Discovery

NEW ORLEANS.—Shell Oil Co. has discovered a new oil field 6 miles west-southwest of Hope Villa townsite, East Baton Rouge Parish, at its 1 Vivian J. Gianelloni, 47-8s-1e. The well came in flowing 454 bbl. of 47°-gravity oil per day through ½-in. choke. It is bottomed at 12,100 ft., and has 7⅝-in. casing cemented at 10,250 ft. and 5-in. at 11,009 ft. Operators perforated the interval at 10,876-90 ft. for testing. Tubing pressure on the test was 4,925 psi.

In St. Bernard Parish, Richardson & Bass have reperforated at 12,900-14 ft. with 56 shots in their promising wildcat, 1-G Albert Ruiz, 136-14s-14e. The hole is bottomed at 13,002 ft., and operators set 5-in. casing at 13,002 ft. This test was drilled approximately 7 miles southeast of the Kenilworth gas field, where the parish has its only production. However, across the parish line, Plaquemines has seen highly successful explorations.

At last report, Progress Petroleum Co.,

First in

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Inc., was drilling at 7,620 ft. in its 1 L. K. Nicholson, 86-6s-9e, Pointe Coupee Parish. Operators will run the first log at 8,500 ft. in the wildcat, a depth where slight shows were found in a previous try on the Nicholson lease. This test is north and east of Maringouin.

North and west of Maringouin, Sinclair Oil & Gas Co. has spudded 2 H. M. Kimball, 86-6s-9e, and is drilling below 300 ft. The first Kimball well found a good oil flow, but the sand section was thin and operators dropped it.

SOUTH LOUISIANA SUCCESSFUL WILDCAT

Calcasieu Parish: New pay at Phoenix Lake —Ohio Oil Co. 3 E. W. Brown, Jr., TD 8,066 ft., top pay 7,986 ft., "B" sand, perf. 7,986-90 ft., 250 bbl. oil per day, 11/64-in. choke, 42.4° gravity.

SOUTH LOUISIANA WILDCAT FAILURE

St. Mary Parish: Superior Oil Co. 1 Walter Kamper et al, 29-15s-9e, dry, TD 12,816 ft.

North Central Texas

Sinclair Conditions Strawn Prospect

WICHITA FALLS.—Three miles north of Benjamin in Knox County, Sinclair Oil & Gas Co. 1 G. H. Beavers, 224-44-H&TC, prospective Strawn sand discovery, prepared to treat with Hydrafrac in order to step up its production.

After perforating with 96 shots between 5,920-32 ft., swabbing recovered 3 bbl. of oil an hour for 6 hours, with no water. The section was treated with 2,000 gal. of acid, and swabbed 59½ bbl. of oil in 8 hours. Total depth was 6,400 ft., in the Ellenburger topped at 6,364 ft.

In southeast Knox County, 4 miles southeast of Munday, Texas Pacific Coal & Oil Co. 2 Louis Cartwright "A," S. Washburn Survey, A-410, cored sand and shale from 4,527-37 ft., of which the bottom 1½ ft. had fair to good shows of oil. A core from 4,537-41 ft. recovered 4 ft. of sand with oil shows, and a drill-stem test from 4,525-41 ft., open 2 hours and 5 minutes, had gas in 26 minutes and recovered 736 ft. of free oil plus 398 ft. of heavily oil and gas-cut mud. Flowing pressure was 250 psi. Testing was to continue.

The 2 Cartwright is the second test for the area and is located 1,260 ft. north of the discovery which found the Strawn sand pay from 4,531-34 ft.

Sun Oil Co.'s 1 J. P. Maddox, 43-1A-H&TC, southwest Nolan County Ellenburger prospect, 7 miles southwest of Maryneal, was testing on the pump from open hole at 7,116-32 ft. after swabbing 22 bbl. of oil in 3 hours. An 18-hour pumping test produced 59 bbl. of oil.

Sun staked location for a 7,500-ft. Ellenburger wildcat in Nolan County, as the 1 Eunice Parramore, 660 ft. from south and 560 ft. from west lines, 55-1A-H&TC, 21 miles soutwest of Sweetwater. Location was said to be on a block of about 10,000 acres held jointly by Sun and Seaboard Oil Co. of Delaware.

Cities Service Oil Co. and Skelly Oil Co. 1 J. P. Cooper, wildcat 1 mile northwest of Roscoe in Nolan County, in NW NW 41-23-T&P, was drilling ahead following a 1-hour test from 7,058-80 ft. which recovered 390 ft. of mud. Salt was recovered on an earlier test from 6,762-80 ft. A 3-hour test in Strawn sand from 6,736-66 ft. had a strong blow of gas which decreased rapidly, and recovered 3,360 ft. of fluid, said to yield 4 bbl. of clean oil, 28 bbl. of oil and gas-cut mud and 18 bbl. of salt water.

C. L. Norsworthy, Jr. 1 Nita Mae Brooks, 71-X-T&P, 6 miles northeast of Maryneal, recovered 60 ft. of mud on a drill-stem test from 6,388-6,410 ft. It was drilling ahead below 7,000 ft.

Sun 3 Beatrice K. Stone, 76-X-T&P, 1½ miles southwest of Sweetwater, was drilling below 4,916 ft. in shale.

R. W. Sutton 1 Seago, NW NW 43-22-T&P, 4 miles west of Sweetwater, was drilling at 2,800 ft.

Youngblood & Foree 1 Kilgore, SW NW 141-1A-H&TC, Nolan County, was drilling lime and shale at 4,306 ft.

Texas Pacific 1 W. H. Bennett Account, NE NW 31-20-T&P, in northeast Nolan County and about 2 miles east of Brodie & Hunt's 1 Aycock, small Ellenburger producer, was drilling shale below 4,715 ft. Tops reported were: Valera 2,180 ft., Dothan 3,180 ft., Saddle Creek at 3,451 ft.

Texas Pacific extended Richardson Caddo field of southern Montague County approximately ½ mile northwest at its 1 Kleinhans, Block 82, Titus CSL, and 1 mile northwest of Salona. On completion the well flowed 192.5 bbl. of 42°-gravity oil a day from the Caddo at 6,080-92 ft.

In north-central Montague, D. H. Bolin 2 Cato Heirs, F. Robertson Survey, confirmed Canyon lime production, as a west offset to the discovery. Drill-stem test from 2,694-2,716 ft. recovered 800 ft. of oil in 1½ hours. Operators were running casing.

NORTH TEXAS (DISTRICTS 9 AND 7-B) SUCCESSFUL WILDCATS

Coleman County: E. A. Gillespie 1 J. W. Roberts, O. H. Gibbs Sur. 154, 4 mi. NW Shield, TD 783 ft., elev. 1,650 ft., pumped 13 bbl. 44°-gravity oil a day, GOR 300 cu. ft.

Great Expectations Oil Corp. 1 Ida Reaves Hickman, H. Rhodes Sur. 631, 6 mi. NE Santa Anna, TD 2,298 ft., elev. 1,524 ft., Marble Falls 2,228 ft., pay 2,250 ft., 3,440,000 cu. ft. gas, 3/8-in. choke, TP 402 psi.

R. B. Slushea and W. E. Cradit 2 Casey O. Herring, Bond & Sanders Sur. 91, A-56, 310 ft. NE 1 Herring, 3 mi. NE Trickham, TD 1,167 ft., perf. 1,143-45 ft., pumped 12 bbl. 38.9°-gravity oil a day.

Haskell County: Crown Central Petroleum Corp. 1 R. A. Gillespie, NE NW 5-3-H&TC, 13 mi. E Stamford, TD 5,303 ft., PB 1,582 ft., pay 1,548 ft., pumped 42 bbl. 37°-gravity oil in 8 hr., base Saddle Creek 1,496 ft., top Flippen 1,587 ft., suggested field name Rockdale.

Shackelford County: E. C. Hooker 1 G. R. Davis, 3-13-T&P, 13 mi. W Albany, TD 1,587 ft., sand pay 1,571 ft., pumped 7½ bbl. 39°-gravity oil a day.

Taxman Oil Corp. 1 Mary O. Harbaugh, Sec. 1,563, TE&L Sur., 14 mi. E Albany, TD 4,394 ft., elev. 1,262 ft., Ellenburger 4,341 ft., perf. 4,370-76 ft., flowed 143.5 bbl. 43°-gravity oil in 12 hr., 10/64-in. choke, GOR 488 cu. ft., CP 760 psi., TP 600 psi.

Taylor County: Geochemical Surveys 1 W. L. Diltz, 14-18-T&P, 1½ mi. SW Merkel, TD 5,409 ft., elev. 1,915 ft., Ellenburger 5,378 ft., flowed 85.89 bbl. 48°-gravity oil a day, ½-in. choke, GOR 360 cu. ft., CP 400 psi., TP 200 psi.

NORTH TEXAS (DISTRICTS 9 AND 7-B) WILDCAT FAILURES

Archer County: Ben Bolton 1 Prideaux, SA&MG Sur., A-444, 6 mi. W Antelope, dry, TD 550 ft.

L. A. Hedrick 2 Elo A. Hausler, Jacob Standerford Sur., A-394, 2½ mi. N Olney, dry, TD 1,147 ft., Gunsight 1,101 ft.

Fred A. Kadane, Jr. 1 Wilxon, Blk. 128, ATNCL Sur., 1½ mi. SE Holliday, dry, TD 1,449 ft.

G. E. Kadane & Sons 1 Rose Mingle, Lot 11, Blk. 3, Clark & Plumb, 2 mi. W Scotland, dry, TD 4,706 ft.

G. E. Kadane 1 W. V. Weinzapfel, Lot 116, Blk. 4, Clark & Plumb, 3 mi. SW Scotland, dry, TD 4,044 ft., elev. 1,033 ft., KMA lime 3,560 ft.

Ted A. Norwood 1 Mrs. Turbeville, Blk. 147, Robert Carson Sur., A-102, 8 mi. SE Mankins, dry, TD 1,583 ft.

Palmer Drilling Co. 1 Ethel Lemmon, Blk. 12, Meade Pasture "55" Subd., 7½ mi. NW Olney, dry, TD 1,310 ft., Gunsight 1,206 ft.

Brown County: Hickok & Reynolds, Inc. 1 Paul F. Lawlis, Robert G. Millikin Sur. 142, 2½ mi. S Cross Cut, dry, TD 2,373 ft., brown lime with oil odor 2,204-15 ft.

Clay County: Jack Grace Production Co. 16-1 Bryant Edwards "M," Blk. 16, Marion CSL, A-308, 6 mi. E Henrietta, dry, TD 6,446 ft.

Coleman County: C. K. Manley 1 B. R. Wooten, Blk. 13, A. White Sur. 161, 2 mi. E Burkett, dry, TD 1,665 ft. in shale.

H. M. Naylor Oil Co. 1 Blanton, Sec. 61, HT&B Sur., 2 mi. E Santa Anna, dry, TD 1,970 ft., dry sand 1,684-91 ft.

Horace E. White 1-A W. H. Finley, Sec. 45, BBB&C Sur., 2 mi. SE Novice, dry, TD 3,611 ft., elev. 1,948 ft., Gardner 3,404 ft., Morris 3,104 ft., Capps 3,142 ft., Jennings sand 3,299 ft., Gray sand 3,556 ft., no shows.

Comanche County: Continental Oil Co. 1 M. W. Helm, Sec. 236, Thomas S. Brown Sur., A-103, 7 mi. NW Comanche, dry, TD 3,190 ft., Marble Falls 2,627 ft., Ellenburger 2,847 ft.

Paul Gardner, J. W. Salyer and Lydia Johnson 1 H. M. Perkins, Blk. 19, Comanche CSL 42, 3 mi. NE Blanket, dry, TD 2,856 ft., elev. 1,687 ft., Barnett 2,537 ft., Ellenburger 2,602 ft., Marble Falls 2,365 ft.

Houston Oil Co. of Texas 1 G. S. Moore, S. Thompson Sur., 1 mi. E Zourette, dry, TD 3,111 ft., Marble Falls 2,591 ft., Ellenburger 3,040 ft.

Cooke County: Bridwell Oil Co. 2 S. W. Poyner, I. Wisdom Sur., A-1167, 5 mi. SW Bulcher, dry, TD 3,001 ft.

Bert Broday 1 J. L. McCracken, Thos. Cook Sur., A-258, 2 mi. N Era. dry, TD 1,575 ft., broken Ellenburger 1,451-88 ft.

M. H. Goss 1 C. C. Hildebrand, J. Harris Sur., A-502, 5 mi. SW Bulcher, dry, TD 2,360 ft.

C. O. Hutchison and M. Nathan 1 T. F. Smith, G. L. Smith Sur., A-914, 1 mi. W Valley View, dry, TD 1,630 ft.

Kingery Bros. and Gaylord H. Chizum 1 Frank R. Inglish, W. W. Howeth Sur., A-1567, 10 mi. S Muenster, dry, TD 2,690 ft., schist 2,689-90 ft.

Eastland County: Jack Chamberlain 1 Mary E. Davenport, Blk. 65, S. J. Robinson Sur., A-423, 1½ mi. S Olson, dry, TD 2,940 ft., elev. 1,565 ft., Caddo 2,825 ft.

Fisher County: Baker Taylor Drilling Co. and L. H. Puckett 1 J. D. Gray heirs, SE SE P. Baird Sur., 10 mi. NW Rotan, dry, TD 7,225 ft., elev. 2,050 ft., Coleman Junction 3,650 ft., Dothan 3,970 ft., Camp Colorado 4,120 ft., Palo Pinto 5,897 ft., Mississippian 6,870 ft., Ellenburger 7,018 ft.

Hardeman County: Russell Maguire 1 E. E. Grimes, SW SE 74-16-H&TC, 7 mi. S Chillicothe, dry, TD 7,211 ft., reef 4,008 ft.

Jones County: Sojourner Drilling Co. 1 H. B. Hamilton, 7-2-T&NO, 4 mi. SE Anson, dry, TD 3,294 ft., elev. 1,120 ft., Valera 960 ft., Dothan 1,800 ft., Saddle Creek 2,111 ft., Flippen 2,173 ft., Canyon reef 3,220 ft.

Shackelford County: Harry Todd 1 F. B. Cloud est., 45-11-T&P, 7 mi. SW Albany, dry, TD 1,145 ft., elev. 1,623 ft., Sedwick 555 ft., Cook 1,113 ft.

Stonewall County: Gene Goff 1 Beulah Branch, SW NW 356-2-H&TC, ½ mi. N Rotan, dry, TD 7,041 ft., elev. 2,111 ft., Dothan 3,810 ft., Strawn 6,220 ft., Brown lime 6,790 ft., Ellenburger 6,990 ft.

C. L. Norsworthy, Jr. 1 D. J. Herbst, SW NW 60-D-H&TC, 3 mi. NE Aspermont, dry, TD 6,406 ft., elev. 1,796 ft., Mississippian 6,145 ft., Ellenburger 6,275 ft.

Wichita County: W. H. Hammon 2 Fassett & Tuttle "C," Blk. 22, K&N Subd., Cherokee CSL, 4 mi. SE Wichita Falls, dry, TD 5,594 ft.

W. H. Hammon 3 Fassett & Tuttle "C," Blk. 29, K&N Subd., Cherokee CSL, 5 mi. SE Wichita Falls, dry, TD 5,332 ft., sand with odor 5,201-07 ft.

L. A. Hedrick 1 E. E. Welborn, Blk. 46, Red River Valley Lands Subd., 7 mi. W Burkburnett, dry, TD 2,002 ft.

XUM

Illinois-Ind.-Ky.

New Oil Pool Found in Saline-White Counties

THE area around the common corner of Saline, Gallatin, White, and Hamilton counties, Illinois, is being watched closely with two wildcats, only 1½ miles apart, showing promise of production. They are J. F. Balderson 1 Bruce, SE NE SE 24-7s-7e, in the northeast corner of Saline County, and George & Wrather 1 Earl Douglas, SW SE NW 17-7s-8e, 1½ miles to the northeast, in the southwest corner of White County.

Both are testing Aux Vases sand, the former at 2,923-55 ft., and the latter at 2,967-82 ft. In drill-stem tests of this play, the Balderson well, with tool open 2 hours, starting flowing gas within 20 minutes and had 290 ft. of clean oil and 300 ft. of salt water in the pipe in the breakdown. The George & Wrather well, with tool open 1 hour, had gas within 9 minutes and recovered 405 ft. of oil and gas-cut mud with some salty oil-cut mud. Total depths of the two wells are 3,161 ft. and 3,138 ft., respectively. In both cases, the pay is being tested through windows opened in alloy sections run in the casing string.

Another new pool also is in the making in Sullivan County, Indiana, where Carter Oil Co. is testing Devonian lime oil showings at its 1 Herbert Drake, NW SE SE 14-9n-10w, 4 miles northwest of Shelburn and 2 miles west of the Martz pool. Bottom of the hole is 2,254 ft. with 7-in. casing at 2,253 ft. Casing has been perforated in various intervals from 2,141 ft. to 2,252 ft. The well flowed clean oil in a drill-stem test of the zone at 2,235-54 ft. The well also is a potential producer in the Aux Vases zone, at 994-1,006 ft., where good showings of oil and gas were encountered.

Delta Drilling Co. has completed its 1 Townsend, SW SE SW 20-N-22, Webster County, western Kentucky, to open a new producing spot southwest of production in the Poole area. The well pumped 121 bbl. of oil and 15 bbl. of water per day from Tar Springs sand at 1,900-17 ft. Pay zone had been shot with 80 qt. of nitro. Hole, drilled to 1,927 ft., had been plugged back to 1,917 ft. with 4-in. casing on top of the sand.

Sohio Petroleum Co. appears to have a good discovery well south of the Kenner pool, 6 miles southwest of Flora, in the southwest corner of Clay County, Illinois. Its 1 Fleming, NW NE SE 2-2n-5e, recovered 800 ft. of clean oil and 90 ft. of oil-cut mud in a drill-stem test of Rosiclare lime at 2,871-76 ft. The test, with tool open 1 hour, was made of an interval at 2,868-80 ft. Bottom-hole pressure was 900 psi. Hole then was deepened to 3,000 ft., taking in the McClosky lime, which also had slight showings, which will be tested. Casing has been run to 2,940 ft., extending through the lower McClosky zone, in which a drill-stem test yielded 20 ft. of gas-cut mud.

ILLINOIS WILDCAT FAILURES

Clark County: F. B. Cline 1 Stoelting, SE NE NE 30-12n-10w, dry, TD 1,081 ft.

Clinton County: H. J. Schlafly et al., 1 Hemminghouse, NW SW SW 9-3n-3w, dry, TD 1,160 ft.

Fayette County: L. B. Hass 1 Stine, NE NW SE 23-6n-3e, dry, TD 2,151 ft.
F. E. Turner 1 Winters, NE NW NW 24-6n-2e, dry, TD 1,800 ft.

Hamilton County: C. E. Brehm 1 Rend, NW SW SW 1-5s-6e, dry, TD 3,530 ft.

Jasper County: J. W. Everhart 1 Kuhl, SE NW SW 17-5n-9e, dry, TD 3,155 ft.

Lawrence County: C. E. Foreman 1 Thompson, SE NE SE 29-2n-12w, dry, TD 1,570 ft.

McDonough County: A. M. Logan 1 Ruebeish, SW SW SW 19-6n-2w4th P.M., dry, TD 410 ft.

Morgan County: Murwood Oil & Gas Co. 1 Sims Community, C NE NE 15-13n-8w, dry, TD 1,081 ft.

Perry County: H. H. Weinert 1 Hendrickson-Zimmerman Community, SW NW SW 5-4s-4w, dry, TD 2,531 ft.

Randolph County: J. A. Wasson 1 fee, NW SW NW 31-5s-5w, dry, TD 2,274 ft.

Saline County: J. T. Vaughs 1 Sullivan-Parker, SW SE NW 14-10s-6e, dry, TD 1,600 ft.

Wabash County: Tuley & Carter 1 Seals, SW NW SW 26-1n-14w, dry, TD 3,010 ft.

White County: D. Hopkins 1 Matz, SW NE SE 23-4s-9e, dry, TD 3,304 ft.

INDIANA SUCCESSFUL WILDCATS

Daviess County: Ed Fitzwilliam 1 Beckett, SE NE NE 13-2n-6w, IP 2 bbl., Benoist 695-705 ft., TD 867 ft.

Gibson County: Sam Garfield et al., 1 Wilberman, NW NW NW 31-2s-9w, IP 275 bbl., Aux Vases lime 1,836-41 ft., TD 1,850 ft.

Posey County: Calvert Drilling Co. and Aurora Gasoline Co. 1-B Mumford, SE NE NW 33-3s-13w, IP 61 bbl., Palestine 1,860-70 ft., TD 2,470 ft.
Howard D. Atha 1 Williman, SE NE SW 18-6s-12w, IP 46 bbl., Waltersburg 1,851-61 ft., TD 2,820 ft.

INDIANA WILDCAT FAILURES

Daviess County: Troy Fuller 1 Field, NE SW SE 3-4n-5w, dry, TD 610 ft.

Gibson County: Skiles Oil Corp. 1 Lockwood, NE SW SW 29-2s-10w, dry, TD 2,251 ft.

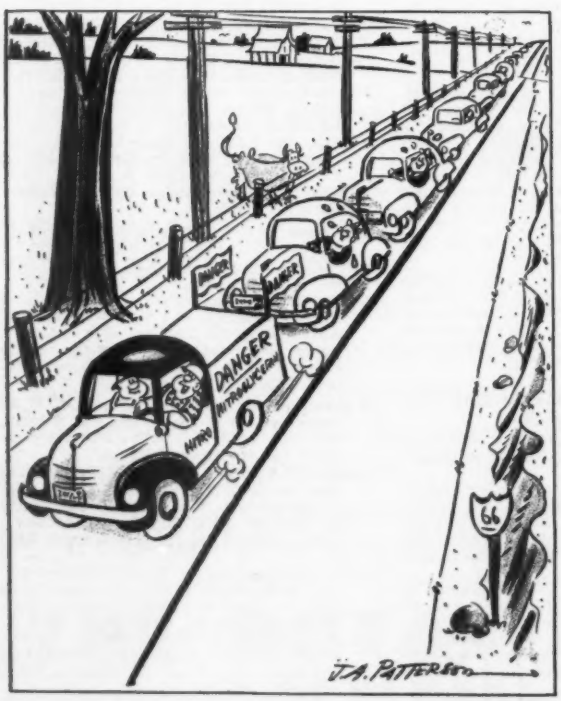
WESTERN KENTUCKY SUCCESSFUL WILDCAT

Webster County: Delta Drilling Co. 1 Townsend Heirs, NW SE SW 20-N-22, IP 121 bbl., Tar Springs 1,900-17 ft., TD 1,927 ft.

WESTERN KENTUCKY WILDCAT FAILURES

Daviess County: Basin Drilling Co. et al., 1 Murphy, NW NW SE NE 25-O-27, dry, TD 2,187 ft.

Henderson County: George S. Engle 1



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XUM

Sigler, NW SW SE 2-N-22, dry, TD 2,825 ft.

Union County: Sun Oil Co. 1 Mason et al., NE NW NW SW 8-P-20, dry, TD 2,656 ft.

EASTERN KENTUCKY

ASHLAND.—In newly discovered Springfork pool of eastern Breathitt County, two offsets to the discovery well are apparently dry in the Big lime (Mississippian), the main pay horizon. United Carbon Co. 26 and 27 E. J. Evans fee respecitvely, one location southwest and east of discovery well, are drilling below 1,200 ft. with noncommercial shows in the Big lime. Operators will likely drill deeper to possible Weir and Berea sand bodies.

Eastern Texas

Gas-Distillate Production Added to Bobby Jo Field

DALLAS.—In Smith County, Delta Drilling Co. 1 Lilla Walker, Fletcher Survey, added gas-distillate production to the new Bobby Jo Paluxy sand field south of Tyler. Completion was through perforations at 7,600-20 and 7,630-46 ft. Production was 1,520,000 cu. ft. of gas daily, plus 24 bbl. of distillate per 1,000,000 cu. ft. Location is ¼ mile southeast of the field discovery. It is the third well for the field and the second producer.

Union Producing Co. 1 J. W. Gilchrist, Quevado Survey, was ready for completion as the second gas-distillate well in North Jacksonville Woodbine field of Cherokee County. Preliminary test was made on perforations at 4,450-55 ft., but production of gas and distillate had not been reported. According to field sources, it was not expected to be quite as large as the discovery, Union Producing 1 Sanders, which rated 105,000,000 cu. ft. of gas daily, from perforations at 4,313-23 ft. The 1 Gilchrist confirmation test is ½ mile west of the 1 Sanders.

American Republics Corp., Houston, announced plans to drill an 8,200-ft. Travis Peak test about 8 miles northeast of Shelbyville in Shelby County. It will be the 1 Jack McLeroy, located 885 ft. from the northeast line of the Stephen English Survey, and 1,320 ft. from north line of an 810-acre tract.

EAST TEXAS (DISTRICTS 5, 6 AND 6-P) SUCCESSFUL WILDCAT

Grayson County: L. O. McMillan 1 Chambers, W. D. Fisher Sur., A-434, ½ mi. Sandusky, TD 7,900 ft., Simpson lime pay, perf. 7,187-89 ft., flowed 396 bbl. of 43°-gravity oil a day, 3/16-in. choke, GOR 959 cu. ft., CP 1,625 psi., TP 1,345 psi.

EAST TEXAS (DISTRICTS 5, 6 AND 6-P) WILDCAT FAILURES

Bosque County: American Republics Corp. 1 F. T. Shaffer, T. R. Hawkins Sur., A-339, dry, TD 5,242 ft., elev. 1,136 ft., Marble Falls 4,540 ft., Mississippian 4,642 ft., Barnett 4,788 ft., Ellenburger 4,933 ft. by samples.

Harrison County: Alma McCutchin 1 Ireland Williams, C. W. Jackson Sur., 11 mi. SE Marshall, dry, TD 6,372 ft., elev. 312 ft., base Massive anhydrite 4,935 ft. by samples.

Hopkins County: W. B. Hinton 1 J. C. Williams est., Samuel South Survey, 2 mi. N Posey, dry, TD 5,208 ft., elev. 525 ft., Woodbine 3,476 ft., Comanchean 4,190 ft., Paluxy 5,123 ft.

Red River County: L. W. Dennis 1 N. M. Howison, John Price Sur., 1 mi. S Bogota, dry, TD 4,963 ft., elev. 380 ft., Paluxy 3,168 ft., Massive anhydrite 4,198 ft.

Wood County: Mack Hays and Eugene Talbert 1 Don Roberts, R. Brown Sur., A-61, 8 mi. NE Hawkins, dry, TD 5,500 ft.

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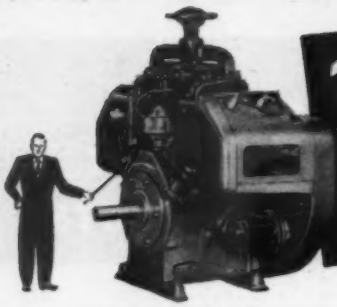

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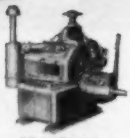
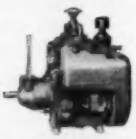


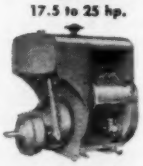
15 to 21.5 hp.

V VF-4



17.5 to 25 hp.

V VP-4



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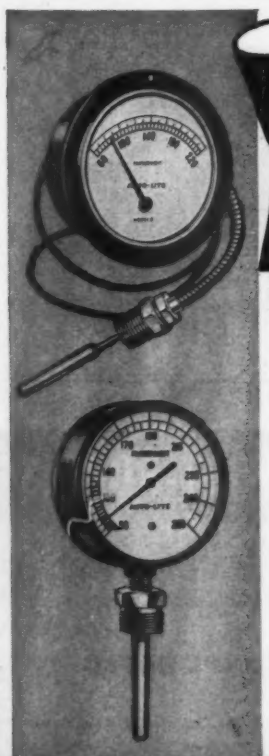

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Louisiana-Arkansas

Tight Hole Rumored Testing Oil Show

SHREVEPORT. — J. D. Collins 1 W. A. Caplis, 5,500-ft. wildcat 2 miles west of Elm Grove field in Caddo Parish, was reported running casing to test a show of oil in the Kilpatrick section from 4,424-34 ft. Total depth was 4,445 ft., in the Rodessa. The well was said to be a tight operation, and the above information was not substantiated by operators.

Continental Oil Co. 1 Wideman, 21-21n-7w, Claiborne Parish, prepared to drill-stem test at 7,589 ft. Cores from 7,407-57 ft. recovered shale and lime with light oil shows. and recovery from 7,457-91 ft. recovered sand with light oil show. A test from 7,417-91 ft., open 1 hour, recovered 31 ft. of gas-cut mud.

Stanolind Oil & Gas Co. 1 Meadors, 8-22n-5w, was drilling below 10,395 ft. in shale after topping the Buckner at 10,195 ft., by samples. Elevation is 267 ft.

Carnes & May 1 Clark, 7-15n-8e, Franklin Parish, had total depth at 4,410 ft., in the Paluxy topped at 3,992 ft., and had casing set to 4,017 ft. Oil sands were reported at 3,851-60, 3,865-77 and 3,963-67 ft. A drill-stem test from 3,851-65 ft., which failed in 20 seconds, recovered 300 ft. of gas-cut mud and had bottom-hole flowing pressure of 150 psi.

One mile north of Saline Lake field, LaSalle Parish, Hunt Oil Co. 25 Louisiana Delta, 25-5n-4e, was said to have flowed at the rate of 325 bbl. of 44°-gravity oil a day on a 4-hour test, through ¼-in. tubing choke. Total depth was 6,005 ft., and perforations were from 5,485-90 ft. Electric log had indicated an oil sand from 5,479-94 ft.

In Arkansas, C. H. Murphy 1 Concannon, SE NE 29-19s-18w, northwest offset to the Tubal field discovery of Columbia County, was drilling below 8,792 ft. in shale. Top of the Cotton Valley formation was 6,600 ft.

NORTH LOUISIANA SUCCESSFUL WILDCAT

Richland Parish: United Carbon Co. 1 J. L. Pipes, SE NW 35-17n-6e, TD 2,418 ft., flowed 11,041,000 cu. ft. gas, open hole Tuscaloosa pay 2,290-2,418 ft., rock pressure 890 psi.

NORTH LOUISIANA WILDCAT FAILURES

Concordia Parish: Kemp Drilling Co. and Austin Stewart 1 Gibson & Williams, SE NE 22-6n-6e, dry, TD 7,006 ft., Moodys Branch 1,962 ft., Cockfield 1,975 ft., Cook Mountain 2,472 ft., Sparta 2,750 ft., Cane River 3,467 ft., Wilcox 3,816 ft.

DeSoto Parish: John E. Yerger 1 B. L. Crow, near NW NW 15-11n-10w, dry, TD 1,771 ft.

Franklin Parish: Duerr & Bolin Co. 1 L. Cummings, NW NW SE 33-16n-7e, dry, TD 3,550 ft., Sparta 417 ft., Cane River 1,030 ft., Talahatta 1,158 ft., Wilcox 1,225 ft., Midway 2,198 ft., gas rock 2,664 ft., Tuscaloosa 2,673 ft., upper Glen Rose, 3,372 ft., anhydrite stringer 3,470 ft.

LaSalle Parish: H. Barksdale Brown & Co. 1 G. Cruse, SW SW NE 36-11n-3e, dry, TD 2,720 ft.

Tensas Parish: David M. Lide 1 Fred Outlaw, 1,880 ft. from N, 1,982 ft. from E SWc 46-13n-12e, dry, TD 8,707 ft., elev. 88 ft., Midway 5,925 ft., Clayton chalk 6,650 ft., Cretaceous 6,720 ft., Eutaw 7,725 ft., lower Cretaceous 8,700 ft.

Webster Parish: W. M. Plaster 1 T. T. Bass, NE SE 30-18n-10w, dry, TD 8,010 ft., elev. 222 ft., Arkadelphia 1,300 ft., Nacatoch 1,380 ft., Saratoga 1,660 ft., Blossom 2,256 ft., Tokio 2,482 ft., Tuscaloosa 3,030 ft., lower Cretaceous 3,100 ft., Paluxy 3,140 ft., Glen Rose 4,960 ft., Massive anhydrite 6,430-7,055 ft., Pine Island shale 7,935 ft.

Winn Parish: C. W. Beene 1 John Lawrence, NE NW 3-12n-2w, dry, TD 1,135 ft., elev. 202 ft., Wilcox 1,100 ft.

Jim McMurray 1 A. L. Smith, CW½ NW

SE 32-12n-1w, dry, TD 1,098 ft., elev. 197 ft.

ARKANSAS SUCCESSFUL WILDCATS

Lafayette County: J. J. Broadus 1 Lester Bros., NW NW NE 22-16s-25w, TD 3,820 ft., pumped 80 bbl. oil a day, Velvin zone, open hole 3,807-20 ft.

Union County: Marine Oil Co. 1 Trigg, NW NE 33-17s-12w, TD 6,158 ft., pumped 75 bbl. oil a day, 100 bbl. water, Cotton Valley perf. 4,422-32 ft.

ARKANSAS WILDCAT FAILURES

Columbia County: Austin E. Stewart 1 Mullins fee, SW SE 23-19s-20w, dry, TD 5,811 ft., elev. 338 ft., Arkadelphia 2,128 ft., Nacatoch 2,227 ft., Saratoga 2,540 ft., Buckrange sand 3,084 ft., Tokio 3,264 ft., Woodbine 3,577 ft., lower Cretaceous 3,745 ft., Massive anhydrite 4,395-4,586 ft., James 5,223 ft., Pettit 5,565 ft., Three-finger lime 5,623 ft., Pettit porosity equivalent 5,676 ft., Travis Peak 5,793 ft.

Nevada County: Lyons & Prentiss 1 Herring, NE NE SW 14-13s-23w, dry, TD 3,010 ft., elev. 372 ft., Midway 162 ft., Arkadelphia 530 ft., Nacatoch 963 ft., Tokio 1,488 ft., Massive anhydrite 1,891-1,993 ft., base James 2,433 ft., Three-finger lime 2,573 ft., Travis Peak 2,642 ft.

Permian Basin

Another Penn. Discovery for Southeast Terry County

MIDLAND.—Southeastern Terry County gained another Pennsylvanian discovery at Union Oil Co. of California 1 Laura A. Cotten, SE NE 91-T-D&W, 4 miles southeast of Brownfield, and 7 miles north and slightly west of Corrigan Fusselman field.

On elevation of 3,262 ft., the well had top of the Pennsylvanian limestone at 9,902 ft. First test from 9,900-28 ft., open 65 minutes, recovered 30 ft. of drilling mud. Core from 9,950-70 ft. recovered 6 in. of white limestone, and a drill-stem test of the section developed an estimated flow of 10-15 bbl. of oil an hour.

Operators cored ahead to 10,002 ft., recovering 11 ft. of limestone having good porosity and oil stains. A drill-stem test of the interval, open 1 hour and 50 minutes, had gas in 5 minutes, rated at 1,750,000 cu. ft. daily, followed by mud in 10 minutes and flowing oil in 14 minutes. It flowed into pits for 47 minutes to clean, then turned into tanks where it gaged 82½ bbl. of 44°-gravity oil in 50 minutes. Drill pipe unloaded while being pulled and there was no recovery. Flowing pressure ranged from 2,150 psi. to 3,825 psi. in 20 minutes, and bottom-hole pressure climbed to 4,175 psi. in 17 minutes.

At last report the well had an additional 31 ft. of saturated limestone in coring ahead to 10,033 ft., and operators were reaming out before making tests.

In Hockley County, Honolulu Oil Corp. and Signal Oil & Gas Co. 1 J. C. Hopper, second producer and north offset to the reef discovery of Ropes field, found water table and was plugging back for completion tests.

A drill-stem test in the reef limestone from 9,327-9,420 ft. developed a flow of 206 bbl. of oil in 2 hours. On the first hour it flowed 105 bbl. of oil and 101 bbl. the second hour. First test on the same section produced 107.25 bbl. of oil in 1 hour, cut with less than 1 per cent sediment. Flowing pressure was 3,500 psi. and shut-in pressure 3,625 psi. The 1 Hopper had top of the reef at 9,289 ft., and has 7-in. casing set at 9,293 ft. Water table in the reef was established on a test from 9,420-45 ft., where recovery was 7,800 ft. of salt water. Electrical surveys were being run before plugging back.

In Sterling County, Humble Oil & Refining Co. 1-B R. T. Foster, 1,965 ft. from south and 2,050 ft. from west lines, 16-T-T&P, 4 miles southwest of Durham San Andres field, and 6 miles southwest of Sterling City, recovered oil on two drill-stem tests in the Wolfcamp section of the lower Permian.

First test from 3,985-4,018 ft., open 1 hour, recovered 1,000 ft. of oil-cut drilling fluid, and 1,550 ft. of 32°-gravity oil. There was no formation water. Open flowing bottom-hole pressure ranged from 225-992 ft., and 15-minute shut-in pressure was 1,287 psi.

It was cored ahead from 4,018-38 ft., recovering 2 ft. of soft limestone with streaks of shale. Second drill-stem test, from 3,985-4,038 ft., open 2 hours and 50 minutes, recovered 200 ft. of oil and gas-cut mud, 1,900 ft. of 32°-gravity oil and 350 ft. of drilling water. There was no formation water. There was some gas but the volume was not estimated. Drilling was to continue to the Ellenburger.

In Kent County, Kewanee Oil Co. 1-D Wilson Connell, SW NE 3-4-H&GN, north offset to its Pennsylvanian limestone discovery, recovered 3,231 ft. of 38°-gravity oil and 470 ft. of oil-cut mud on a drill-stem test in the Pennsylvanian from 6,859-82 ft.

WEST TEXAS (DISTRICTS 8 AND 7-C) SUCCESSFUL WILDCATS

Borden County: Vickers Petroleum Co., Inc. and Norwood Drilling Co. 1-A J. R. Canning, NE SW 142-25-H&TC, 3 mi. N Von Roeder field, 1½ mi. NE Amerada 1 Canning, dry at 8,435 ft.; TD 5,937 ft., elev. 2,320 ft., Wolfcamp 5,906 ft. by samples, pay 5,912 ft., flowed 1,267.2 bbl. 41°-gravity oil a day, 25/64-in. choke, open hole 5,912-37 ft., GOR 280 cu. ft., TP 240 psi., CP 120 psi.

Gaines County: Stanolind Oil & Gas Co. 1 Nick Alley, NW NE 22-A27-PSL, 1 mi. SE Boydell, TD 11,187 ft., PB 4,585 ft., elev. 3,415 ft., San Andres 4,280 ft., pay 4,130 ft., pumped 7 bbl. 27°-gravity oil a day from open hole 4,123-4,585 ft., Strawn 8,438 ft., Devonian 8,605 ft., Simpson 10,530 ft., Ellenburger 11,045 ft., pre-Cambrian 11,175 ft.

Runnels County: J. D. Andrews 1 Ray V. Willis, 660 ft. out of NE corner, G. Hancock Sur. 437, 6 mi. SW Lawn, TD 2,690 ft., elev. 1,914 ft., Surratt sand 2,670 ft., pumped 131 bbl. 40.5°-gravity oil a day, natural.

(Continued on page 228)

Ohio Fields

Clinton Sand Well Flows 620 Bbl. in 24-Hour Test

COLUMBUS.—Jay Hunt et al., 6 Cooperider, Section 3, Bowling Green Township, Licking County, flowed 620 bbl. in 24 hours, making it the largest well completed in Ohio in recent years. The well was shot with 170 qt.

W. C. Adair's 4 William Bratton in Hopewell Township, made 185 bbl. in 24 hours after shot.

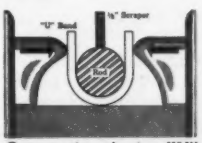
Willard Shrider et al., completed a good well on 1 Paul Funk in the Third quarter of New Castle Township, Coshocton County. Clinton sand at 3,258-91 ft. showed some gas, and sand at 3,298-3,315 ft. made 30 bbl., natural, and 245 bbl. in 24 hours after a 120-qt. shot. A mile and a half to the west in the same township, Oxford Oil Co. topped the Clinton on the 2-C J. C. Staats at 3,179 ft. The test made 10 bbl. natural and 70 bbl. the first day after shot.

Hambleton et al., extended the gas field in the north part of Dover Township, Tuscarawas County, ½ mile to the south. The 1 Alvin Lind, Lot 29, logged the white Clinton at 4,536-56 ft. and gaged 2,000,000 cu. ft., natural, with 1,210 psi. pressure.

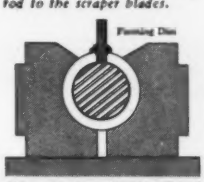
Jesse Williams et al., 1 Charles Law, Section 30, Decatur Township, Washington County, topped the salt sand at 1,045 ft. and bottomed at 1,051 ft. with a natural open flow of 850,000 cu. ft.

PARAFFIN SCRAPERS
(PAT. REG. U. S. PAT. OFF.)

CRALL Spiral Pariffin Scrapers are designed to fit any sucker rod, for 2" or 2½" tubing. Millions of feet of CRALL Scrapered Rods, installed in thousands of pumping wells throughout the United States and Canada, are operating to the complete satisfaction of our customers.



Cross section showing "U" band being die-formed around rod to the scraper blades.



Cross section showing band held under pressure around rod while ends of band are shrink-grip attached to scraper blade. Neither Scrapers nor Bands are welded to the sucker rod.

1. **Scrapers alternate—one right, one left—eliminating tendency of rod to unscrew.**
2. **Scrapers are attached at our plants and shipped direct to you or stocked at supply stores.**
3. **Pass Scrapers every pump stroke, up and down. Rod string does not rotate.**

The original installation is the only cost. Order your CRALL Spiral Scrapered Rods from your supply store or wire, write or phone for full descriptive literature.

PETROLEUM SPECIALTY CO.
P. O. BOX 1640 PAMPA, TEXAS

Manufacturing and Fabricating Plants at Pampa and Sundown, Texas

XUM

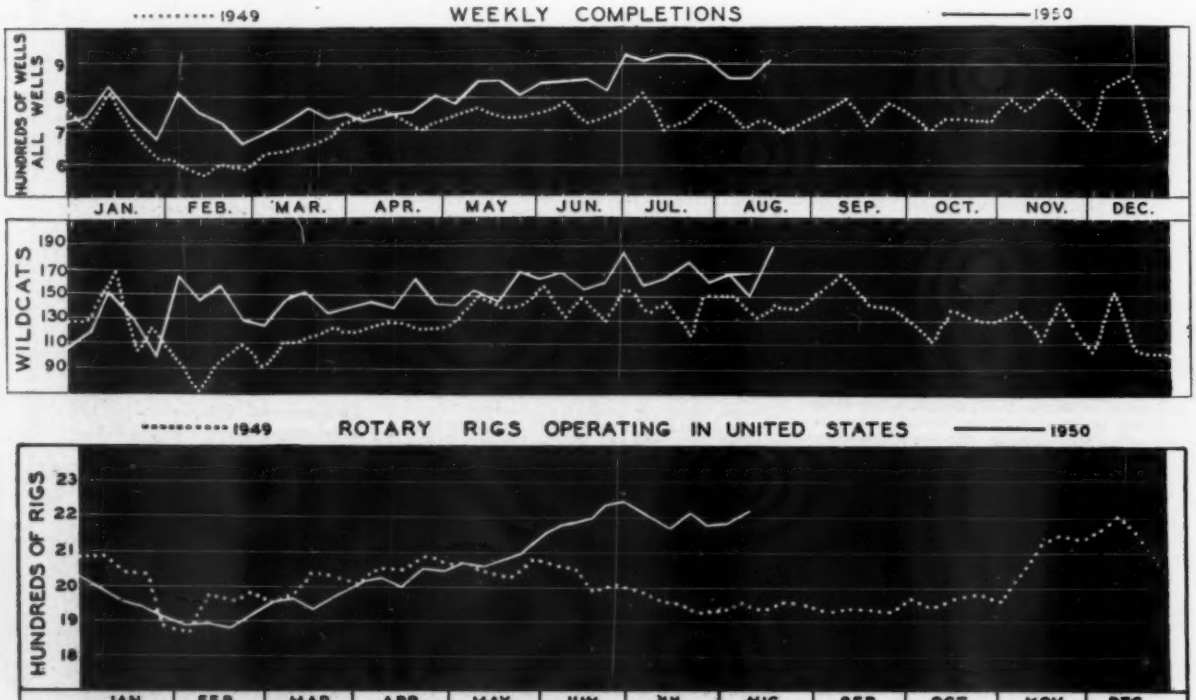
CURRENT STATISTICS

EXPLORATION

WEEKLY WELL COMPLETIONS . . . WEEK ENDED AUGUST 19, 1950

	Total of all wells					Aug. 15		Wildcat completions and discoveries										
													Cumulative total, 1950					
	Comp.	Oil	Gas	Dry	Footage	1950	1949	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
New York	17	9	0	*8	24,752	413	686	0	0	0	0	0	0	0	0	0	0
Pennsylvania	28	11	9	†8	43,142	849	1,081	0	0	0	0	0	0	0	1	2	3
West Virginia	22	3	13	6	56,327	419	314	0	0	1	0	1	0	0	13	15	28
Ohio	21	7	6	8	36,959	621	691	0	0	0	0	0	1	0	2	7	10
Indiana	29	13	0	16	54,039	1,020	842	4	0	0	2	6	37	0	1	175	213
Kentucky	30	10	2	18	52,770	700	573	1	0	0	3	4	17	0	1	54	72
Illinois	70	38	0	32	150,215	1,656	1,566	0	0	0	14	14	32	0	1	380	413
Michigan	16	5	0	§11	40,487	535	614	0	0	0	6	6	19	0	4	180	203
Kansas	60	32	3	¶25	211,555	2,337	2,038	3	0	0	17	20	62	0	7	374	443
Nebraska	2	0	0	2	8,285	66	19	0	0	0	2	2	4	0	1	32	37
Oklahoma	105	64	1	¶40	391,113	3,419	2,748	5	0	0	11	16	104	6	11	418	539
Texas	324	197	8	119	1,527,015	10,285	8,589	15	0	2	66	83	324	25	71	1,618	2,038
North Central (Dist. 7-B & 9)	95	40	1	§54	293,512	3,141	2,820	6	0	1	29	36	140	2	19	636	797
West (Dist. 7-C & 8)	103	89	0	14	516,330	3,079	2,045	3	0	0	8	11	67	2	2	305	376
Panhandle (Dist. 10)	0	0	0	0	0	569	633	0	0	0	0	0	1	0	2	12	15
Eastern (Dist. 5, 6, & 6-P)	33	18	2	13	168,029	746	527	1	0	0	5	6	9	4	2	130	145
Gulf Coast (Dist. 2 & 3)	50	28	1	21	289,197	1,439	1,286	3	0	0	12	15	56	10	25	230	321
Southwest (Dist. 1 & 4)	43	22	4	17	259,947	1,311	1,278	2	0	1	12	15	51	7	21	305	384
Louisiana	59	36	2	21	295,129	1,546	1,418	1	0	1	9	11	32	13	5	130	180
Northern	39	21	2	16	123,813	625	800	0	0	1	8	9	4	2	2	61	69
Southern	20	15	0	5	171,316	721	618	1	0	0	1	2	28	11	3	69	111
Arkansas	13	10	0	3	43,887	261	204	2	0	0	2	4	7	0	0	63	70
Mississippi	5	1	1	3	22,327	203	220	0	0	0	2	2	8	2	0	73	83
Southeastern States	2	1	0	1	10,070	42	32	0	0	0	1	1	1	0	1	24	26
Montana	34	23	2	9	66,949	142	159	0	0	0	4	4	1	0	0	22	23
Wyoming	16	11	0	5	72,257	357	380	2	0	0	2	4	14	0	0	46	60
Colorado-Utah	2	2	0	0	5,811	47	80	1	0	0	0	1	3	0	0	30	33
New Mexico	11	6	1	4	38,234	395	333	0	0	0	1	1	10	1	0	35	46
California	40	25	2	13	190,140	1,113	1,663	0	0	0	10	10	15	0	2	237	254
Miscellaneous	0	0	0	0	0	34	15	0	0	0	0	0	0	0	0	9	9
Total United States	906	504	50	352	3,341,463	26,460	24,265	34	0	4	152	190	691	47	121	3,924	4,783
Total previous week	877	500	70	307	3,170,821	....	....	25	0	3	122	150	657	47	117	3,772	4,593
Total August 19, 1949	752	390	69	293	2,609,039	....	....	17	1	2	121	141	609	57	123	3,480	4,269

Service wells included: *8, †7, §2, ¶1.



DAILY AVERAGE PRODUCTION FOR WEEK

	Aug. 19 crude oil	B. of M. Aug. demand	Aug. 12 crude oil
Alabama	1,950	1,600	1,900
Arkansas	82,250	90,000	81,900
California	887,500	905,000	886,200
Colorado	62,000	67,000	61,900
Eastern	62,950	64,000	63,000
Florida	1,500	1,400	1,675
Illinois	174,600	186,000	172,600
Indiana	31,700	31,000	31,600
Kansas	306,800	298,000	293,600
Kentucky	28,100	30,000	27,700
Louisiana	574,800	578,000	574,800
North Louisiana	116,250	.....	116,250
South Louisiana	458,550	.....	453,550
Michigan	44,400	47,000	43,700
Mississippi	109,400	113,000	106,250
Montana	23,300	24,000	22,900
Nebraska	2,550	3,000	2,500
New Mexico	135,575	150,000	135,575
Oklahoma	468,050	455,000	464,100
Texas	2,463,950	2,240,000	2,463,950
Dist. 1 (Southwest)	29,400	.....	29,400
Dist. 2 (Southwest)	140,425	.....	140,425
Dist. 4 (Southwest)	222,400	.....	222,400
Dist. 3 (Gulf Coast)	432,450	.....	432,450
Dist. 5 (Eastern)	41,050	.....	41,050
Dist. 6 (Eastern)	97,650	.....	97,650
East Texas field	274,800	.....	274,800
Dist. 7-C (West)	61,350	.....	61,350
Dist. 8 (West)	846,100	.....	846,100
Dist. 7-B (W. Central)	72,325	.....	72,325
Dist. 9 (N. Central)	154,000	.....	154,000
Dist. 10 (Panhandle)	92,000	.....	92,000
Utah	3,350	4,000	3,600
Wyoming	155,800	162,000	156,100
Total United States	*5,620,525	5,450,000	5,595,550
Change from previous week, up	24,975		
Canada	86,680	.....	81,563

Total U. S. production January 1-August 19 .... †1,195,685,015 bbl.
Same period last year (crude plus cond.) ..... 1,176,611,800 bbl.

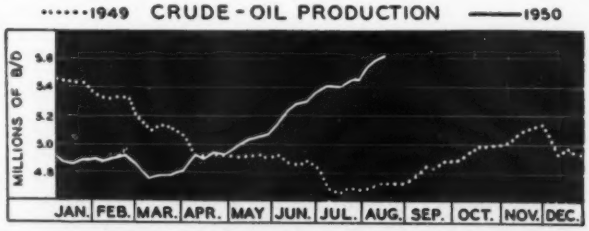
*Not including 96,555 bbl. condensate. †Including 22,487,640 bbl. condensate.

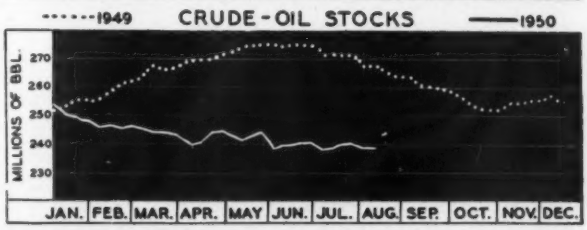
CRUDE-OIL STOCKS BY STATES OF ORIGIN*

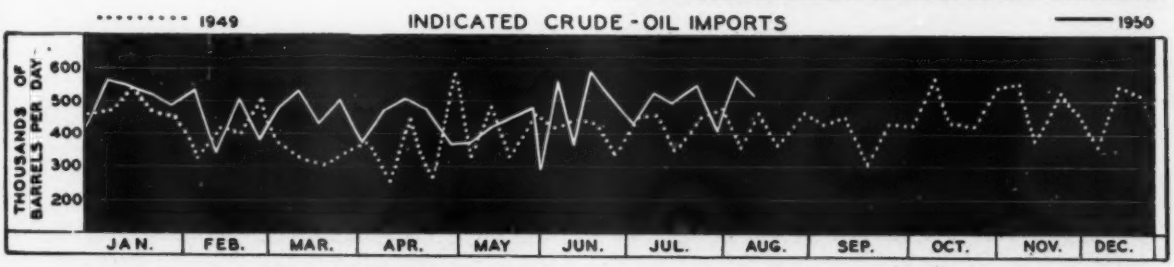
(Thousands of barrels)

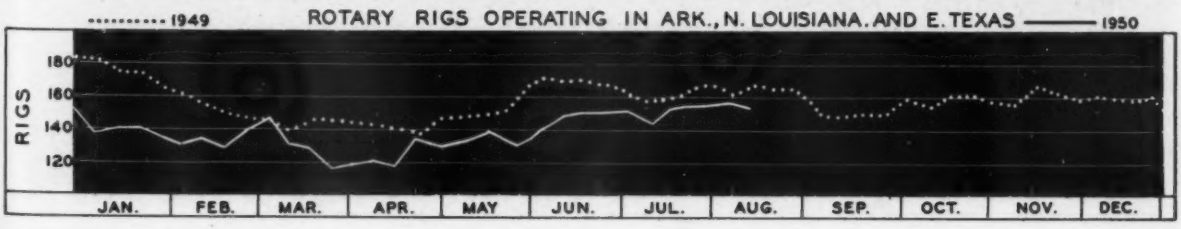
	Aug. 12, 1950	Aug. 5, 1950	Aug. 13, 1949
Pennsylvania Grade	2,745	2,769	3,318
Other Appalachian	1,488	1,416	2,102
Illinois, Indiana, Michigan	9,230	9,232	13,993
Arkansas	2,792	2,805	2,945
Louisiana	14,483	14,522	15,614
North	3,134	3,230	3,824
Gulf	11,349	11,292	11,790
Mississippi	2,266	2,191	2,926
New Mexico	6,031	6,060	7,522
Oklahoma and Kansas	33,007	32,961	39,736
Texas	113,833	113,604	122,988
East Texas	14,702	15,498	16,146
West Texas	43,526	42,659	49,638
Texas Gulf	27,391	26,878	28,955
Other Texas	28,214	28,569	28,249
Rocky Mountain	11,925	12,094	14,264
California	33,871	34,277	35,551
Foreign	6,883	6,881	7,771
Total	238,554	238,812	268,730

*Bureau of Mines.







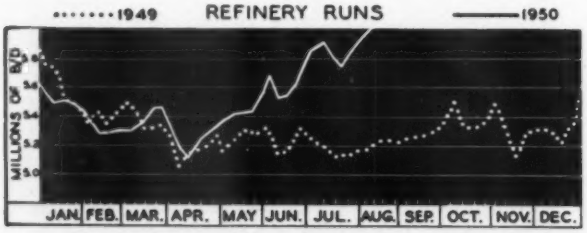


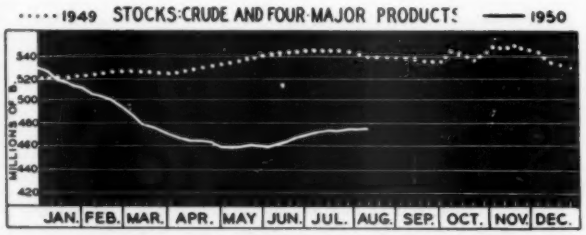
XUM

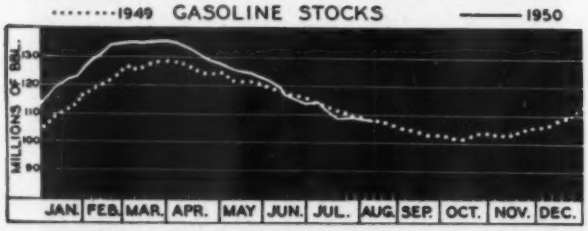
A.P.I. REFINERY REPORT, AUGUST 12
(Thousands of barrels)

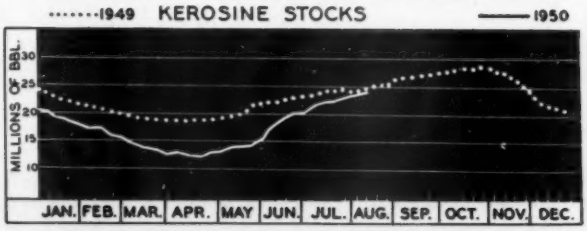
District—	Daily avg. crude runs	Daily average production: Gasoline*	Kerosine	Distillate	Residual	Stocks at refineries, bulk terminals, in transit and in pipe lines: Gasoline†	Kerosine	Distillate	Residual	Bureau of Mines, August 1949: Daily avg. crude runs	Daily average production: Gasoline*	Kerosine	Distillate	Residual
East Coast	1,002	401.9	33.6	230.8	193.4	25,223	7,501	15,909	10,801	746	317.5	26.6	168.2	182.0
Appalachian:														
District 1	103	39.7	5.1	14.3	7.9	2,354	413	617	395	84	39.7	4.2	10.6	9.2
District 2	65	33.3	3.4	9.4	14.7	1,002	148	179	233	63	34.8	3.9	4.5	11.5
Ind., Ill., Ky.	1,074	570.1	67.3	168.3	145.4	22,268	5,011	10,729	4,528	882	486.6	45.0	120.1	118.0
Okla., Kans., Mo.	518	293.9	12.6	110.8	63.0	10,709	1,360	6,089	1,267	430	242.8	15.2	81.6	60.5
Inland Texas	221	136.6	13.6	31.6	42.6	3,153	602	1,389	807	218	144.7	7.1	29.2	43.0
Texas Gulf Coast	1,367	636.8	89.8	263.7	236.3	15,994	4,054	9,879	4,896	1,252	607.8	68.9	222.2	232.0
La. Gulf Coast	488	224.6	56.6	105.3	51.4	5,965	2,684	3,518	1,821	426	222.8	40.1	110.0	49.0
N. La. and Ark.	66	27.1	6.3	12.7	12.0	2,535	453	560	290	78	32.1	6.2	12.4	15.5
Rocky Mountain:														
New Mexico	13	7.1	.4	1.9	2.7	94	25	65	34	12	6.9	0.1	2.3	3.1
Other Rocky Mtn.	195	87.9	5.0	38.3	34.6	3,769	465	1,747	855	183	81.1	4.8	31.8	37.1
California	932	441.7	9.3	111.0	308.4	15,452	912	12,372	15,883	867	376.4	9.3	109.4	317.0
August 12, 1950	6,044	2,900.7	303.0	1,098.1	1,112.4	108,518	23,628	63,053	41,810	5,241	2,593.2	231.4	902.3	1,077.9
August 5, 1950	5,944	2,826.1	293.5	1,059.9	1,154.1	108,895	23,560	‡62,235	41,791	.....	.....	.....	.....	.....
August 13, 1949	5,227	2,626.1	197.6	817.7	1,010.3	108,174	25,329	73,815	67,818	.....	.....	.....	.....	.....

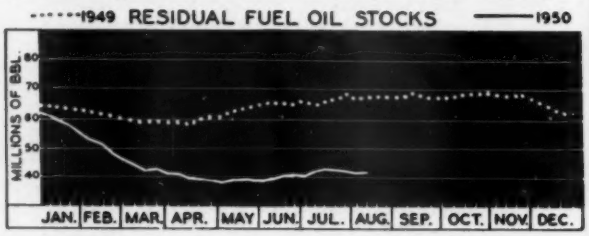
*At refineries including natural blended. †Finished and unfinished. ‡Revised in California.

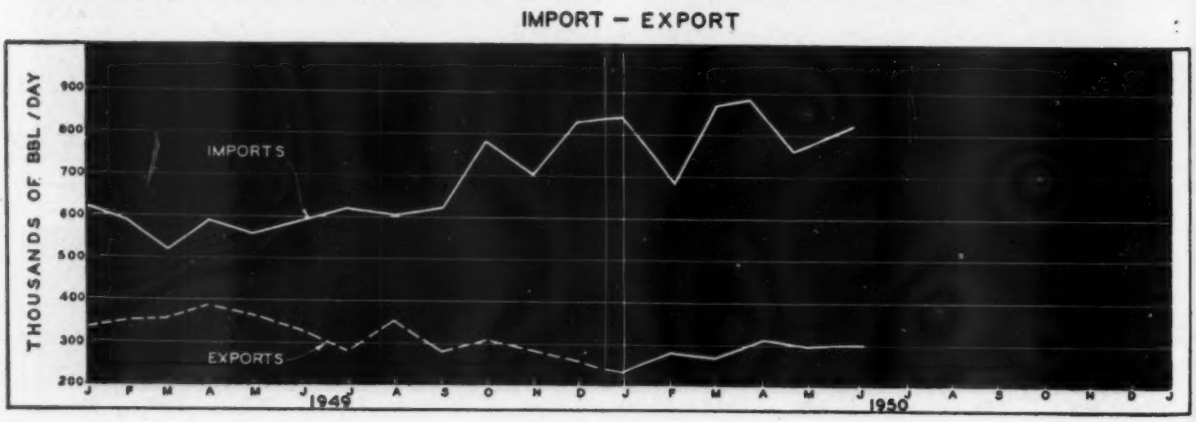












CRUDE PRICES

GRAVITY SCHEDULE

Gravity—	Signal Hill, Calif.	Okla-homa, Kansas	Gulf Coast Tex.*	West Tex.†
18-18.9	$1.69	....	....	....
19-19.9	1.77	....	....	....
20-20.9	1.85	$2.25	....	$2.12
21-21.9	1.93	2.27	....	2.14
22-22.9	2.00	2.29	....	2.16
23-23.9	2.08	2.31	....	2.18
24-24.9	2.15	2.33	$2.56	2.20
25-25.9	2.23	2.35	2.58	2.22
26-26.9	2.31	2.37	2.60	2.24
27-27.9	2.37	2.39	2.62	2.26
28-28.9	2.42	2.41	2.64	2.28
29-29.9	2.48	2.43	2.66	2.30
30-30.9	2.54	2.45	2.68	2.32
31-31.9	2.59	2.47	2.70	2.34
32-32.9	2.64	2.49	2.72	2.36
33-33.9	....	2.51	2.74	2.38
34-34.9	....	2.53	2.76	2.40
35-35.9	....	2.55	2.78	2.42
36-36.9	....	2.57	2.80	2.44
37-37.9	....	2.59	2.82	2.46
38-38.9	....	2.61	2.84	2.48
39-39.9	....	2.63	2.86	2.50
40 and above	....	2.65	2.88	2.52

*For crude from Daboval, El Campo, and Sand Point.

†Includes Lea County, New Mexico. Last general price change represented a 50-cent increase becoming effective December 6, 1947.

FLAT CRUDE PRICES

Representative posted schedules per barrel.

East Texas†	$2.65
Kettleman Hills, California*	2.77
Beauregard Parish	2.60
Illinois Basin	2.77
Pecos County, Texas (Yates)	2.35
Bradford, Pennsylvania	3.89
Eastern Ill. and Western Ind.†	2.77
Tomball, Texas Gulf Coast	2.83

*37°-37.9°. †35° and above.

WITH the peak-demand season for gasoline drawing to a close, more and more attention is focused on distillate and heavy-fuel markets. Gasolines are more readily available on most markets even though shipments continue at a high level. For the past 3 weeks almost all of the demand on refineries for gasoline has been met out of current production. Total gasoline stocks of August 12 were only about 400,000 bbl. less than on July 22.

On the other hand, residual stocks dropped 600,000 bbl. in the 3-week period and combined stocks of kerosine and distillate fuels gained only about 4,500,000 bbl. This gain in total heating-oil stocks of only 185,000 bbl. daily is abnormally low for this time of the year. Refinery production of light and heavy fuels was 18 per cent greater than in the same weeks last year.

Since the big gains in shipments out of primary storage cannot be accounted for by actual increases in summer consumption, it can be assumed that the prospect of a tight fuel market during the coming winter has resulted in more fillup sales to resellers and consumers.

Esso Standard Oil Co. announced price increases for kerosine, diesel oils, and No. 2 fuel effective August 19. Esso met the Socony-Vacuum Oil Co., Inc., increase in postings for New York Harbor amounting to .4 cent a gallon for kerosine and .5 cent for No. 2 fuel but raised the Gulf Coast cargo postings of both products by .5 cent.

Light heating fuels are still hard to find on the Group 3 spot market despite recent increases in price. Kerosine moved up .125 cent on the low to 8.75 cents a gallon and .25 cent on the high to 9 cents. The range for No. 2 fuel was from 7.875 to 8.125 cents with some asking prices above the high.

REPRESENTATIVE QUOTATIONS

Representative spot-market quotation of leading suppliers as of August 21, 1950. Figures are f.o.b. plant for tank-car shipments in cents per gallon, except for residual fuel oil which shows the price per barrel and wax, in cents per pound.

GASOLINE, KEROSINE, AND FUEL OILS

	Mid-Continent Group 3	New York Harbor (barge)	Texas Gulf Coast
Regular gasoline, 80-82 octane	10⅜-10½	12.5-12.75	10¾-11½
Premium gasoline, 86-88 octane	11¼-11½	13.5-13.75	11½-12½
42-44 w.w. kerosine	8¾-9	9.1-9.6	8½-8⅝
No. 2 straw fuel oil	7⅞-8¼	8.0-8.5	7½-7¾
No. 6 residual	$1.65-1.75	$2.15	$1.80-1.85

NATURAL GASOLINE

	Group 3	North Texas	N. La.
Grade 26-70	5⅞	5⅜	5⅝
Grade 18-55	7.05	6.55	6.80

LUBRICATING OILS

South Texas

200 vis., No. 2-3 neutral	12.5
750 vis., No. 3-4 neutral	14.75
2.000 No. 5-6 neutral	16.5

LUBRICATING OILS

Mid-Continent

150-160 vis., D bright stock, 0-10 pp.	22-24
200 vis., No. 3 neutral, 0-10 pp.	13.5-15.5

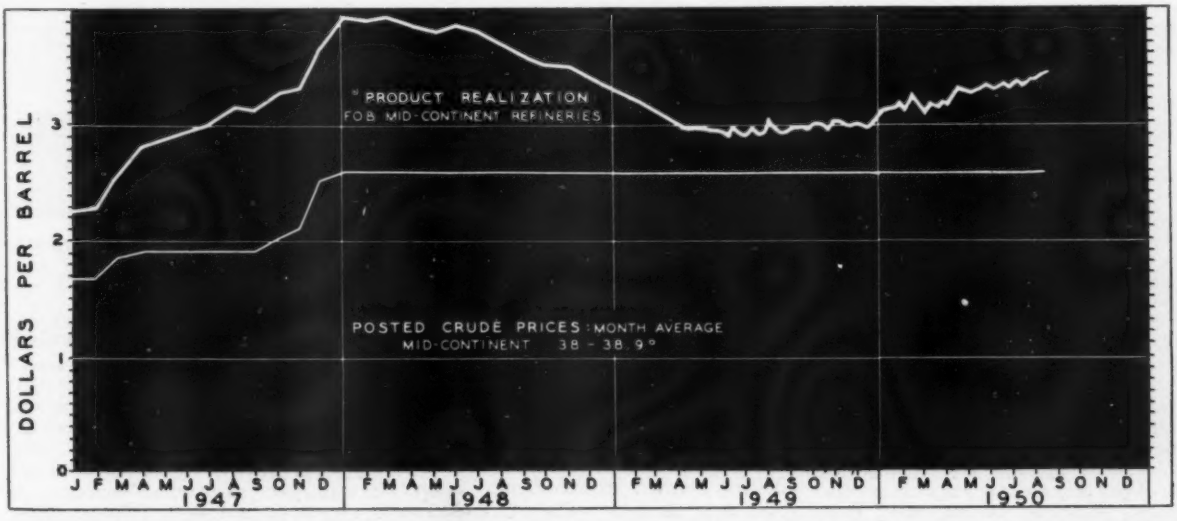
Western Pennsylvania

145-155 vis., 10 p.t. bright stock	27.5
180 vis., 0 p.t. neutral	28.5

WAX

Mid-Continent

132-134 A.M.P.	4.50


DOLLARS PER BARREL
3
2
1
0
PRODUCT REALIZATION
FOB MID-CONTINENT REFINERIES
POSTED CRUDE PRICES: MONTH AVERAGE
MID-CONTINENT 38 - 38.9°
J F M A M J J A S O N D
1947
F M A M J J A S O N D
1948
F M A M J J A S O N D
1949
F M A M J J A S O N D
1950

In this trend chart refinery realization is based on average Mid-Continent grade crude oil (not 38° gravity only) and average prices for refinery products as published in The Oil and Gas Journal basis Oklahoma (Group 3). Refinery yields confined to gasoline, kerosine, distillate, and fuel oil. Realization averaged $3.45 for week ended August 12, $3.43 for previous week, and $2.98 for August 1949.

XUM

EQUIPMENT MEN ... in the News

Hoil Engineering Announces Expanded Sales Program

Hoil Engineering Corp. has expanded its sales and service program with representative offices in Los Angeles, Casper, Wyo.; Houston, and Alberta, Canada. With main offices in the new First National Building, Tulsa, and plant facilities at Sapulpa, Okla., the corporation is in position to furnish immediate service to its

E. W. YENZER

W. S. SWAN

customers throughout the major oil-producing areas.

The organization of the newly founded company known as Wilson-May Construction Co., pipe-line contractors, is now associated with Hoil Engineering Corp., and has recently secured several contracts for gas-distribution systems in Tennessee. Ernest W. Yenzer has been appointed sales manager of the firm, and will direct sales of all Hoil products, as well as coordinate contract negotiations and public relations for Wilson-May Construction.

William S. Swan will represent Hoil, sales and service, in the Rocky Mountain region with offices in Casper and Alberta.

Honeywell Strengthens Field Sales Staff

Promotions and additions affecting its field staffs, industrial and valve divisions, were announced last month by Minneapolis-Honeywell Regulator Co. Charles F. Woods has been named valve division sales manager for the Southwest region. He will make his headquarters at Dallas. Edward J. Byrne, formerly with the company's Houston branch, has succeeded Woods as industrial manager of the Dallas branch.

Howard W. Griesbach has been appointed industrial manager of the Milwaukee branch. He was in the Chicago branch for the past few years. Additions to the field sales staffs include: Louis C. Schultz to Chicago, and William E. Van Horne to Rochester, for industrial sales; William J. Kirby to Los Angeles, and P. R. Vogel to Houston, on industrial supplies sales.

Transfer of field men include: Lawrence E. Kennedy, transferred from Syracuse to Atlanta; George Massey, from Atlanta to Nashville; A. R. King, from Boston to Worcester, Mass.; Gerald G. Walker, from Detroit to Saginaw, Mich.; W. J. Kilroy, from Detroit to Grand Rapids, and John Koerner, from Pittsburgh to Youngstown, Ohio. In addition, Carl Bohnlein has been transferred from Chicago industrial service to industrial sales at Menasha, Wis.

Ruth Barr Observes 25th Anniversary With Ad Firm

Ruth V. Barr, secretary and treasurer of Russell T. Gray, Inc., Chicago advertising agency that handles many industrial accounts, has observed her twenty-fifth anniversary with the firm.

Harvey A. Scribner, president of the agency, presented her with a gold ring watch incorporating the firm's trade mark as a memento of the occasion.

United Centrifugal Opens Houston Regional Office

For the purpose of furnishing more comprehensive engineering and sales service to the Mid-Continent area, United Centrifugal Pumps, Division of United Iron Works, will open a regional office in Houston, on September 1.

H. JOHNSTON

The new regional office will be managed by Halley Johnston, who will act in an advisory and supervisory capacity over the activities of the Houston, Tulsa, St. Louis, and Denver district offices. Johnston, a member of the American Society of Mechanical Engineers, has had extensive experience as a pump-application engineer dating back to 1928. He has specialized in oil-industry problems. Prior to his present appointment, Johnston served as western district engineering-sales manager for United Centrifugal Pumps.

Halliburton Loads Its 1,500th Car of Shell Cement

Everett E. Knott, sales manager, Halliburton Portland Cement Co., takes a hand in loading the 1,500th car while Ellroy King, vice president, secretary, and treasurer, and A. I. Anderson, works manager, look on.

On August 1, Halliburton Portland Cement Co., Corpus Christi, Tex., loaded its 1,500th car of Shell Brand cement. The newly constructed plant began making shipments on March 20 of this year and since that time the mill has furnished cement for 170 dealers located in the South Texas and Rio Grande Valley areas. In addition to this, several hundred carloads have been used in cementing oil wells.

The Halliburton plant with a capacity of 4,000 bbl. of finished cement daily, is located on the deep-water channel of the port of Corpus Christi. The rear entrance to the plant has been dredged to accommodate passage of Halliburton barges laden with shell and clay. Oyster shell, used fo. its calcium carbonate content, is dredged from nearby Nueces Bay. Clay, containing other essential ingredients is dredged from Corpus Christi Bay.

Core Lab Elects Two New Directors

J. D. WISENBAKER

Following the recent acquisition of controlling interest by a group of employes, Core Laboratories, Inc., Dallas, has announced the appointments of Ralph W. Parnell, Shreveport, and Ben A. Elmdahl, Houston to its new board of directors. Other members of the board include John D. Wisenbaker, Dallas, president of the company, and two representatives of Case-Pomeroy, New York. The latter organization formerly held full ownership of Core Lab.

R. W. PARNELL

B. A. ELMDAHL

R. S. BYNUM

J. W. BARBOUR

Coinciding with these appointments was an election of two vice presidents, Rufe S. Bynum, Midland, and J. W. Barbour, Jr., Oklahoma City, and of Clair C. Miller, Dallas, as secretary and treasurer.

Manufacturers Light & Heat Enlarges Engineering Staff

The staff of the gas-engineering department of Manufacturers Light & Heat Co., Pittsburgh, has been enlarged by the recent employment of three men who received engineering degrees at university commencements in June.

John E. Furbee and J. Carl Bovankovich, both chemical engineers, will give special attention to the control of natural-gas pipe-line corrosion. Frank E. Fulton, a petroleum engineer, will concentrate on the design and development of natural-gas transmission facilities.

According to A. B. Lauderbaugh, chief gas engineer, these men enter the company under the cadet engineering program which was established in 1947. All three will make their headquarters in the company's Pittsburgh general offices.

Foster Jr. Boosted To New Foster Wheeler Position

Foster Wheeler Corp. has announced the appointment of Pell W. Foster, Jr., as vice president in charge of a newly created equipment division. This division will comprise the steam, industrial, marine, and condenser departments, which are existing commercial engineering groups serving the power generation, industrial processing, and marine industries.

In making this announcement, Earle W. Mills, president and chairman of the board, stated that the new division would coordinate the activities of the present departments with the manufacturing and sales group.

Foster, a director and vice president in charge of production since 1946, will continue as active head of the production and procurement departments.

Travis Is Sales Head for Blackmer's Eastern Area

C. V. Travis has been appointed Eastern division sales manager for Blackmer Pump Co., manufacturer of rotary industrial and petroleum power, hand, and truck pumps, according to B. L. Gordon, president. Travis, a graduate of Wesleyan University, was formerly associated with General Motors Corp., Whitlock Cordage Co., Sargent Lord & Co., and Publicker Industries.

F. P. Goertz will be associated with Travis in the New York office, and will direct sales and service for Blackmer in the Newark district of the Eastern division.

Spang-Chalfant Names Two To New Sales Positions

Charles J. Ramsburg, Jr., has been appointed manager of sales, welded products, and J. K. Sutter has been named Pittsburgh district manager for Spang-Chalfant Division of National Supply Co., according to an announcement by E. A. Booth, general sales manager for the division.

Ramsburg has been Pittsburgh district manager for the division since January of this year, and prior to that time, was assistant district manager of the New York office. Sutter, who replaces Ramsburg, had been Boston sales representative for the division since 1944.

S. D. Day to Represent Oklahoma Glass Fiber

S. D. Day Co., Houston, has been appointed Gulf Coast distributor for Oklahoma Glass Fiber Corp. of Tulsa, it has been announced by H. T. (Bus) Holland of the glass-fiber reinforcement company.

The Day company will serve the territory of Texas, Louisiana, Mississippi, and Alabama. Day, who recently established his own firm at Houston, was formerly with Barrett Co.

R. L. Hopkins Named Tournarope Sales Engineer

R. L. HOPKINS

R. L. (Bob) Hopkins, who has been associated with oil-field and industrial applications of wire rope for many years, has been named Tournarope sales engineer for southwestern United States, it has been announced by W. H. Wilson, Tournarope sales manager. With headquarters at Houston, Hopkins will handle applications and sales in Texas, New Mexico, Oklahoma, Colorado, and Louisiana.

Hopkins' wide experience in the oil and industrial fields includes 5 years with John A. Roebling's Sons Co. for whom he was sales engineer with headquarters in New Orleans. He also formerly was with Baker Oil Tools, Inc., in a sales capacity.

National Supply Buys Atlas Imperial Diesel Assets

National Supply Co. took steps last month to broaden its existing sales and service facilities as well as its horsepower range of diesel engines when it purchased assets of the engine division of Atlas Imperial Diesel Engine Co., Oakland. The purchase included the name, patents, trade marks, designs, together with certain machinery and equipment, as well as sales and service outlets and inventories throughout the United States and Canada from Halifax, N. S., south to Houston on the east and Gulf coasts and from Ketchikan, Alaska, south to San Diego, on the West Coast.

National Supply has long been a major manufacturer of diesel, dual-fuel, and natural-gas engines at its engine division plant located at Springfield, Ohio. The manufacture of Atlas Imperial diesel engines and parts will be carried on at the Springfield plant, according to F. H. Kilberry, head of National Supply's engine division.

XUM

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EQUIPMENT FOR SALE

FOR SALE: One Gumbo Buster 26" Oil Bath rotary table in good running condition. Attractive price. Melton Supply Company, Box 1360, Semniole, Oklahoma.

WELL equipment. New and used spudders, rotaries, core drills, all sizes and types. Cable tools, drill pipe, bits, pipe. Fishing tools rented. Everything for well service. Pressey & Son, Pueblo, Colo.

FOR SALE: 300 Amp Westinghouse welding machine powered by 6-BK Waukesha engine. Completely overhauled. Less than 50% of new price. Melton Supply Company, Box 1360, Seminole, Oklahoma.

FOR SALE: One 7¼ x 14 Whelan model 11000 Slush pump. New fluid end, gear box A-1. Melton Supply Company, Box 1360, Seminole, Oklahoma.

FOR SALE at our Sasakwa Gasoline Plant—1 Fluor Cooling Tower, 10 bays high 5 bays wide. Cities Service Oil, Patridge, Bartlesville, Oklahoma.

NEW 24" O.D. PIPE

7,000 ft.—24" O.D. Pipe, ¼" wall, Republic Electric Fusion Weld, 30' lengths, Plain Ends beveled. Location: Harvey, La.

MID-STATES PIPE & SUPPLY CO.
Ph. 2-9128 Tulsa, Okla.

FOR SALE

9—230 H.P. Bessemer Type 10 Engines with compressors, Steel Buildings, Valves and Fittings complete for installation. Located Salem, Illinois Oilfield.

ENGLE PETROLEUM, INCORPORATED
Box 655, Evansville, Indiana
Telephone 5-5179

NEW STEEL PIPE

20" OD with 5/16" wall,
20-40 foot lengths,
1200 feet.

24" OD with .281 wall,
40 foot lengths,
2000 feet.

24" OD with 5/16" wall,
20-40 foot lengths,
400 feet.

30" OD with ¼" wall,
20 foot lengths,
1000 feet.

Immediate delivery subject to prior sale.

Write—Wire—Phone

SONKEN-GALAMBA CORPORATION
2nd and Riverview (X-614)
Kansas City 18, Kansas
THaicher 9143

EQUIPMENT FOR SALE

FOR CABLE TOOLS
DEGEN PIPE AND SUPPLY CO.
Box 107, Red Fork Station, Tulsa, Oklahoma

FOR SALE near Vernon, Texas: 1—40 HP Superior, 4 Cycle Gas Engine Driving Power Serial #18611, Cities Service Oil Company, Patridge, Bartlesville, Oklahoma.

FOR SALE: Model 75 Wichita Trailer Type 3 drum-drilling and clean-out rig, A-mast, 120 HP Waukesha motor, 4500' of ¾" drilling & ½" sand lines, dog house and drilling tools. J. W. Gookin, Box 641, Electra, Texas. Phone 560 or 1188.

Several Army Surplus 4½" x 6" Gaso Duplex 1860 Pumps—two piece skid mounted with Chrysler 8 cylinder engines. Will sell pumps only or complete units about half price.

H. H. COFFIELD
ATTN: W. H. Orr
Phones: 132—Rockdale, Texas
A-86064—Houston, Texas

SALT WATER PIPE

60c ft. 5⅛" x 4 9/16"
100 lb. Test
Roll or Bolted Couplings—$1 up

GOOD-ALL MFG. CO.
Ogalala, Neb.

EQUIPMENT FOR SALE

FOR SALE: 36-L Bucyrus-Erie, excellent condition, 1947 Model, rubber mounted. D. E. Davis, Poneto, Indiana. Phone: Bluffton, Indiana, 972-2.

USED ROTARY AND CABLE TOOL DRILLING TOOLS, WIRE LINES. E. A. KELLY, BOX 861, OKLAHOMA CITY. PHONE 5-6407.

FOR SALE at our Lacy Gasoline Plant Seminole County, 1 Braun Portable Distillation Unit, Size G, Serial #7190 complete with building, Cities Service Oil Company, Partridge, Bartlesville, Oklahoma.

COUPLINGS:

5½" OD and 7" OD 8 Rd. Thd. New, perfect, H-40 and J-55.

Box D-650

THE OIL AND GAS JOURNAL
Tulsa, Oklahoma

FOR SALE

Hydraulic Casing Pulling Units, Hydraulic Jacks, Casing Spiders, Rings & Slips. Also,
Skid Mounted Cementing Unit, Complete.
Write or Call

OKLAHOMA MACHINE & SUPPLY CO.
Phone 780 Ada, Okla. P. O. Box 997

LIQUIDATION SPECIALS!
REFINERY EQUIPMENT
for IMMEDIATE DELIVERY

TOWERS and VESSELS
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PUMPS, TURBINES and MOTORS
★
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★
INSTRUMENTS, METERS, GAUGES

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YOUR NEEDS
and for
COMPLETE LISTINGS

DULIEN STEEL PRODUCTS, INC.
of Washington
P. O. BOX 667
COTTON VALLEY, LA.
PHONE: COTTON VALLEY 26

EQUIPMENT FOR SALE

FOR SALE: Wilson Giant draw works, powered by two JL-1335 Buda engines with Wilson chain compound. Unit completely overhauled. Can sell separate or with a complete rig. For information, call or write Melton Supply Company, Box 1360, Seminole, Oklahoma.

WAR SURPLUS MACHINERY

Gaso, Byron Jackson, Aurora, Wayne, Lombard & Hale Fire Pumps with Engines, 1½ to 25 KW Generator Sets or Light Plants, Engines, Suction Hose, Fire Hose, Victaulic Couplings & Etc. Write for listing. H. A. McCarthy, 310 Thompson Bldg., Phone 5-3296, Tulsa, Oklahoma.

EQUIPMENT FOR SALE

FOR SALE: #3 National DRILLING MACHINE, complete with 12 x 12 floor sills, 3" walk and floor, new bandwheel, casing rack, house, belt hall, steel mast, steel brake wheel with rotary block lined 12" brake band, O.C.S. chain driven sand reel with 2 brakes and chain, turn buckles and guy lines complete, including string of drilling tools complete from 12" to 6" with Wilson elevators, dog house, tool boxes, light plant, water pump. Young Drilling TRANSMISSION complete with low gear box; H.X.C. Hercules dual ignition MOTOR, equipped for natural gas or butane-volume tank for same. Located at Bristow. Call or write R. R. Kirchner, Bristow, Oklahoma.

FOR SALE

GAS GATHERING AND FLOW LINE PIPE

NEW AND USED SEAMLESS, LAPWELD AND ELECTRIC WELD, PLAIN END PIPE

15,000′	1½" O.D. x .188" Wall, New E. W., A-179, Plain End, 16 Ft. Lengths.
25,000′	3" O.D. x .300"/.350" Wall, New Seamless, Plain End, 16-30 Ft. Lengths.
1,800′	3½" O.D. x .375" Wall, 12#, New Seamless, Plain End, 20-30 Ft. Lengths.
25,000′	4" O.D. x .130"/.160" Wall, 7#, New Seamless, 16-26 Ft. Lengths.
10,000′	4" O.D. x .165" Wall, 7#, New Electric Weld, A-83 Tubes, 20 Ft. Lengths.
700′	4" O.D. x .375" Wall, 14.52#, New Seamless Plain End, 13-20 Ft. Lengths.
1,170′	4½" O.D. x .437" Wall, 19#, New Seamless, Plain End, 20-30 Ft. Lengths.
330,000′	4" Std. Black, 10.79#, New Lapweld, 20 Ft. R.M.L. Beveled ends (August, September and October delivery).
400,000′	6⅝" O.D. x .218" Wall, 14.97#, New Lapweld, Beveled ends (August, September and October delivery).
2,400′	8⅝" O.D., 28.55#, Used, like new, 80% Seamless, 20% Electric Weld, 15 to 40 Ft. Lengths.
10,000′	8⅝" O.D., 22 and 24#, Used No. 2 Grade, Lapweld, Range 1, Plain End.
6,000′	10¾" O.D., 28.04#, Used No. 2 Grade, Lapweld, Range 1, Plain End.
500′	18" O.D. x .281" Wall, 53.22#, New electric weld, 40 Ft. Lengths, beveled ends.
1,000′	20" O.D. x .250" Wall, 52.73#, New electric weld, 40 Ft. Lengths, beveled ends.
300′	20" O.D. x .281" Wall, 59.23#, New electric weld, 16-21 Ft. Lengths, plain ends.
3,000′	20" O.D. x .312" Wall, 65.70#, New electric weld, 35-40 Ft. Lengths, plain ends.
1,160′	20" O.D. x .344" Wall, 72.16#, New electric weld, 18-20 Ft. Lengths, plain ends.
1,420′	20" O.D. x .344" Wall, New electric weld, 40 Ft. Lengths.
500′	22" O.D. x .281" Wall, New electric weld, 40 ft. Lengths.
1,380′	24" O.D. x .312" Wall, 79.03#, New electric weld, 40 Ft. Lengths.
4,100′	26" O.D. x .260"/.300" Wall, 75.82#, New electric weld, Plain ends, 15-40 Ft. Lengths.

This material available for immediate delivery, all subject to prior sale.

NEW AND GOOD USED SEAMLESS AND LAPWELD CASING AND TUBING AVAILABLE IN ALL DESIRABLE SIZES FOR IMMEDIATE DELIVERY, SUBJECT TO PRIOR SALE. WIRE OR PHONE COLLECT—SIDNEY 1791—FOR PRICES. ACT NOW!

A. J. STRUBEL

Sidney 1791 . . . 4946 Murdoch, St. Louis 9, Mo.

For Sale At Eunice, New Mexico

1—10,000 Ft. Power Rig complete less drill pipe and drill collars—Wilson Titan Draw Works—3 L.R.O. Waukeshas—A-1 condition.

Approximately 5 acre yard and camp all enclosed by fence. Shop building 60 ft. x 30 ft. Fine for drilling or hauling contractor. All utilities in.

Extra drilling equipment such as swivels, hooks, elevators, links, blow out preventers, mud pumps, engines, etc.

Contact:

Ashby Drilling Company

Phone: Logan 6-6639, 3415 Westminster Avenue, Dallas, Texas

EQUIPMENT FOR SALE

ASKANIA VERTICAL MAGNETOMETER, compensated, A-1 condition. Box D-628, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE: 2000′ rotary rig complete. Completely overhauled Sullivan Model 200 drill with 5 x 8 GD pump mounted on a White truck. KB7 International truck, pole trailer, drill pipe, light plant, tool house and tools. J. W. Byrd, 413 W. Hill, Oklahoma City, Okla.

FOR SALE: Drilling Rig: Brewster B0190 draw works W/NKU 210 H.P. Waukesha, 6x16 Gardner-Denver pump W/225 H.P. 6 cylinder LeRoy, with or without 5000′ 4½ drill pipe, now drilling 5000′ hole near Shreveport. Arthur Arnold, Box 3003, Shreveport, La.

FOR SALE: New 100 ton Hydraulic, pipe, tube and shape bending press. $5000 FOB Astoria, Oregon. Orval Eaton, City Hall, Astoria, Oregon.

NEW CASING AND TUBING

5½" J-55—15½# and 2⅜" OD tubing to trade only for interest or override in proven territory.

Send full details and map.

W. C. BERRY

P.O. Box 1858 Tulsa, Okla.

FOR SALE

One Ingersoll-Rand Type 4, XVG2 Heavy Duty Direct Connected, four-cycle gas engine driven two-stage gas compressor, 4 power cylinders 11x12—350 rpm compressor cylinders 15½ x 10 x 12—capacity 915 cfm—discharge pressure 100 psig—equipped with water circulating pump—air filter—back fire relief valve—lubricator—oil filter, and automatic pressure regulator.

One Roots - Connersville Rotary Blower Type HD-RS—Size 14 x 14 with CI bedplate for direct coupling to drive—maximum capacity 2940 cfm at 900 rpm and Maximum pressure (9 psig).

One Roots-Connersville Rotary Blower Type HD-RS—Size 12 x 12 with CI bedplate for direct coupling to drive—maximum capacity 2040 cfm at 600 rpm and Max. pressure (9 psig).

One National Transit 4¾" x 8" Vertical Triplex Single acting Plunger Pump—hot oil type bought to handle 107 gpm oil at 750° F. and 100 psig discharge pressure at 65 rpm.

One new TS-12 Nash Hytor 2-Stage Vacuum Pump—capacity 148 cfm at 28" vacuum with 15 HP 1150 rpm open 3-phase, 60 cycle, 440 volt motor.

One National Transit Gas Engine, 8 cylinders 6 x 9, 108 BHP at 600 rpm direct coupled to 100 KW, 480 volt, 3 phase, 60 cycle Electric Machinery generator with exciter and switch gear.

VELSICOL CORPORATION

330 E. Grand Ave. Chicago, Illinois

EQUIPMENT WANTED

WANTED: USED 4½" DRILL PIPE
Box D-606, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED: Any tonnage 5½" OD & 7" OD seamless T & C New or Grade A Used. Spot delivery only, must be priced right. Box D-652, The Oil and Gas Journal, Tulsa, Oklahoma.

HELP WANTED

EXPERIENCED Geophysicist with geological background to review, interpret seismic data. Extensive knowledge of Gulf Coast area. Permanent location in Houston. State age, training, experience. Salary commensurate with experience and general ability. Reply Box D-651, The Oil and Gas Journal, Tulsa, Oklahoma.

REFINERY ECONOMIC ANALYST: Integrated petroleum company has opening for chemical engineer to supervise refinery economic analysis group. Position requires minimum of two years' experience in preparation of cost and process studies, familiarity with catalytic cracking, and at least one year of training in accounting and business administration. Age limits 25-35. Address replies to Box D-637, The Oil and Gas Journal, Tulsa, Oklahoma.

XUM

HELP WANTED

FOREIGN and Domestic Oil Employment Directory covering the oil industry, showing where to apply for jobs. Price $5.00 Oil Industry Mailing List, Box 2603, Tulsa Okla.

PETROLEUM Engineer or Geologist with experience in evaluation and subsurface studies in Gulf Coast wanted by sound independent. Age 30-45. In application state salary expected and enclose college transcript. Box D-631, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM CHEMISTS—Petroleum refinery located in New Jersey has openings for several Chemists with Petroleum Refinery Laboratory experience. Excellent opportunities for the right men. Salary open. Submit resume on education and experience. Box D-653, The Oil and Gas Journal, Tulsa, Oklahoma.

DRILLING COMPANY now operating in Permian Basin has opening for capable contact man or person in position to obtain contracts. Salary or interest basis. Replies confidential. Box D-641, The Oil and Gas Journal, Tulsa, Oklahoma.

HELP WANTED

Mechanical Draftsman, piping, concrete, pressure vessels, strength of materials. Furnish complete data, salary requirement, military status and sample of work.

Personnel Department, Cities Service Oil Company, Bartlesville, Oklahoma

WANTED
EXPLORATION DEPARTMENT MANAGER

Aggressive independent producer with AAA-1 rating wants man to head exploration department. Must have degree in geology, minimum of ten years geological experience in Oklahoma, some land department experience preferred. Age 30 to 45. Write giving full details and interview will be arranged. This is permanent and attractive position for right man.

Box D-655, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED
Drilling Superintendent

$850.00 per month and new six-room bungalow. Applicant must be qualified for West Texas area.

Submit qualifications including experience and education. All replies will be treated confidentially. (Our employes know of this advertisement.)

Write Box C-645,
THE OIL AND GAS JOURNAL,
Tulsa, Oklahoma

SEISMOLOGIST

Experience, five years or more, required for Seismic Supervision and Interpretation in Head Office of Major Oil Company operating in Saskatchewan. Salary commensurate with experience and ability.

All replies confidential.

Apply in writing to Chief Geophysicist,

SOHIO PETROLEUM COMPANY

1022 Albert St., REGINA, SASK.

HELP WANTED

EXPERIENCED Geophysicist with geological background for review and interpretation of seismic data. State age, training, experience. Reply Box D-654, The Oil and Gas Journal, Tulsa, Oklahoma.

SALES ENGINEERS
OPERATIONS SUPERVISORS
PERFORATOR OPERATORS

Only Experienced Men Need Apply.

WRITE ONLY

WELEX JET SERVICES, INC.
3909 Hemphill Street, Fort Worth 9, Tex.

ESTIMATOR

Experienced ENGINEER familiar with Oil Refinery design and capable of estimating process equipment from flow diagrams.

Give full information, experience record and salary expected.

ARTHUR G. McKEE & CO.

2300 CHESTER AVE.
CLEVELAND 1, OHIO

SITUATIONS WANTED

DISTRICT REPRESENTATIVE, Sales Engineer, Manager for Texas or Gulf Coast. Experienced, capable, widely acquainted. Employed in key capacity, desire position offering better opportunity. Top business, personal references. Box D-657, The Oil and Gas Journal, Tulsa, Oklahoma.

MECHANICAL Engineer, B.S. in M.E., 32, experienced in gasoline and cycling plant design, construction and operation. Interested in equipment design or application with progressive company, preferably West Coast location. At present employed by major oil company. Box D-656, The Oil and Gas Journal, Tulsa, Oklahoma.

CHEMICAL ENGINEER, 10 years outstanding experience, mainly petroleum refining and synthetic fuels development, including administrative pilot plant and refinery work. Extensive fluidization experience. Box D-629, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEER, with 10 years much varied experience in production, drilling, and well completions, now engaged in responsible position with major company, desires association with progressive independent. Age 31, family, best references. Box D-638, The Oil and Gas Journal, Tulsa, Oklahoma.

DRILLING SUPT., age 39, 22 yrs. drilling and production in Gulf Coast area, 12 yrs. as supervisor, presently employed, best of references, desires position with aggressive independent. Box D-648, The Oil and Gas Journal, Tulsa, Oklahoma.

DRILLING Contractor operating in West Texas and New Mexico desires to contact small or medium-sized independent oil company who needs an operating manager. Personal interview desired. Twenty years experience in all phases of the oil industry. Address replies to Box D-644, The Oil and Gas Journal, Tulsa, Oklahoma.

GRADUATE MECHANICAL ENGINEER: 38, with 9 years design and development experience on oil field equipment—5 years drilling and production experience. Good record and capacity to develop and create new ideas. Desire position with good opportunities with equipment or service company. Box D-624, The Oil and Gas Journal, Tulsa, Oklahoma.

ATTENTION: Well established oil well drilling contractor desires to manage and supervise: Individuals', groups', small or medium-sized oil companies' drilling, production and operating problems in Central and Western Texas, and New Mexico. Personal interview by appointment is desired. Makin Drilling Company, Box No. 131, Ph. No. 131, Hobbs, New Mexico.

SITUATIONS WANTED

EXPERIENCED Petroleum Engineer-Geologist desires connection with active independent. Ten years with major companies and private practice in executive supervision of drilling, completion, production, geological and reservoir evaluation work. Prefer interest participation. Excellent references. Box D-632, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST: Desires position with aggressive company. Thoroughly familiar with subsurface and drilling supervision. Experience in West Texas and Mid-Continent. Box D-649, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST - GEOPHYSICIST now responsible for planning and directing exploration program for strong company is interested in joining aggressive independent operator or company on contract—salary—over-ride basis. Graduate geologist with twenty years geological and geophysical experience in Mid-Continent and Gulf Coast areas. Good discovery record. Services should be beneficial to one entering the oil business or one wishing to stepup exploration and development program. Apply Box D-647, The Oil and Gas Journal, Tulsa, Oklahoma.

CHEMIST-GLASSBLOWER: Fifteen years refinery and gasoline plant experience, including supervision, laboratory, gas analysis, water treating and plant processing. Speak Spanish, would consider foreign employment. Available October 1. Box D-635, The Oil and Gas Journal, Tulsa, Oklahoma.

AUDITOR-OFFICE MANAGER, CPA, Fifteen years experience, accounting and taxes, principally oil industry. Desires change. Box D-640, The Oil and Gas Journal, Tulsa, Oklahoma.

EXPERIENCED FIELD ENGINEER, field superintendent for major last five years, desires to become general superintendent for active company, Mid-Continent area. Correspondence confidential. Box D-646, The Oil and Gas Journal, Tulsa, Oklahoma.

ROYALTIES

I OFFER royalties 1/16th land owners royalty in the County of Burleson, Texas. Low price. Write for full details. John Stouppas, 175 E. Long St., Columbus, Ohio.

WE will buy producing or non-producing oil royalties. Standard Security Company, 115 Broadway, New York 6.

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San Juan Basin & Permian Basin. Write Harry S. Wright, Wright Bldg., Farmington, New Mexico.

ELK CITY POOL—(Oklahoma)
Royalties at bargain. A. S. Berry, owner, 522 Wright Building, Tulsa, Oklahoma. Phone 5-5402. Investors with capital solicited for purchases in pool and trend.

WANTED
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LEGAL BLANKS

BURKHART LEGAL BLANKS since 1906. Oil-Gas (all states), Business, Real Estate, Legal Forms, Leases, Revised With Government Regulations, Commercial Printing. Catalog and Samples on request. Burkhart Printing & Stationery Company, 115 South Cincinnati, Tulsa, 3, Oklahoma.

WANTED

WANTED: Small producing oil royalties. Also drilling deals. Navarro Royalties Company, Odessa, Texas.

WANTED: SURPLUS Chemicals, Oils, Waxes, Solvents, Wastes and Residues of all kinds. Chemical Service Corporation, 96-06 Beaver St., New York 5, N. Y.

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For sale by owner, good six room home on 185 foot by 190 foot tract. Natural gas. Fine water. All city convenience. Garden, small fruits, wonderful shade trees. Mild climate. Write P. O. Box 385, Rogers, Arkansas.

LEASE AND DRILLING BLOCKS

SHALLOW Production, Allen County, Kentucky, 11 Pumping Wells—10 bbls. per day. 18 Wells to Recondition. Joseph Thomas, 50 Radnor Circle, Grosse Pointe Farms 30, Michigan.

13 WELLS, 110 acre lease shallow producing from 700' Berea, near Ashland, O. Many good locations, low cost terms. E. N. Rehler, Allegany, N. Y.

SECONDARY RECOVERY; 20 wells 300 acres, Red Fork and Bartlesville sands, 1000 ft. depth. Want development on percentage or override basis. Box D-643, The Oil and Gas Journal, Tulsa, Oklahoma.

TEN thousand acres leases on axis of former U.S. Petroleum Reserve, Rocky Mountain Region. Oil seeps from untested Madison, Devonian and Ordovician formations. Will make attractive deal. Box D-627, The Oil and Gas Journal, Tulsa, Oklahoma.

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6376 Clayton Road, St. Louis 17, Mo.

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PATENT ATTORNEYS

PATENT Practice before U. S. Patent Office. Validity and Infringement Investigations and Opinions. Booklet and form "Evidence of Conception" forwarded upon request. Lancaster, Allwine & Rommell, Registered Patent Attorney, Suite 418, 815-15th Street, N.W., Washington 5, D. C.

CALENDAR

August

Western Petroleum Refiners Association, regional-technical meeting, Leonard Refineries Auditorium, Alma, Mich., August 28.

September

Tri-State Oil Show, Grayville, Ill., September 2-4.

American Chemical Society, 118th national meeting, Stevens Hotel, Chicago, September 3-8.

American Association of Petroleum Geologists and Society of Exploration Geophysicists, regional meeting, jointly with Geological Association of Canada, Banff Springs Hotel, Banff, Alta., Canada., September 5-8.

National Chemical Exposition, Chicago Coliseum, Chicago, September 5-9.

American Institute of Chemical Engineers, regional meeting, Minneapolis, September 10-13.

Instrument Society of America, national exhibit and technical meeting, Coliseum, Houston, September 10-14.

American Petroleum Institute, Division of Transportation, Subcommittee on Products Pipe Line Technology, Lennox Hotel, St. Louis, Mo., September 11-13.

American Society of Mechanical Engineers, and Instrument Society of America, Municipal Auditorium, Buffalo, N. Y., September 11-15.

National Petroleum Association, Hotel Traymore, Atlantic City, N. J., September 13-15.

National Association of Corrosion Engineers, Shreveport section, school meeting, Caddo Hotel, Shreveport, September 13-15.

American Petroleum Institute, Lubrication Committee, Hotel Traymore, Atlantic City, September 14.

Instrument Society of America, annual instrument conference and exhibit, Municipal Auditorium, Buffalo, N. Y., September 18-22.

American Society of Mechanical Engineers, fall meeting, Hotel Sheraton, Worcester, Mass., September 19-21.

American Society of Mechanical Engineers, petroleum mechanical engineering conference, Roosevelt Hotel, New Orleans, September 24-28.

NOMADS

Tulsa Nomads, third Friday of each month. After Five Room, Tulsa Hotel.

Dallas-Fort Worth Nomads, first Monday of each month, Greater Dallas Club.

Houston Nomads, second Monday of each month. Ye Ole College Inn, Houston.

Los Angeles Nomads, second Wednesday of each month. Jonathan Club.

Ohio Mineral Industries Conference, sponsored by Ohio State University and Ohio Department of Natural Resources, Ohio Museum Auditorium, Columbus, September 25-26.

October

Independent Petroleum Association of America, annual membership meeting, Jefferson Hotel, St. Louis, October 2-3.

American Gas Association, annual convention, Atlantic City, N. J., October 2-6

Mid-Continent Oil and Gas Association, Texas division, Dallas, October 4-5.

Petroleum Branch, American Institute of Mining and Metallurgical Engineers, Mid-Continent meeting, Roosevelt Hotel, New Orleans, October 4-6.

American Association of Oilwell Drilling Contractors, annual meeting, Mayo Hotel, Tulsa, October 9-10.

Instrumentation for the Process Industries, fifth annual symposium, Texas A. & M. College, College Station, Tex., October 11-13.

Petroleum Branch, American Institute of Mining and Metallurgical Engineers, West Coast meeting, Elks Club, Los Angeles, October 12-13.

Oil Progress Week, October 16-21.

American Association of Petroleum Geologists, Pacific Section, Ambassador Hotel, Los Angeles, October 19-20.

Society of Economic Paleontologists and Mineralogists, Pacific Coast Section, Ambassador Hotel, Los Angeles, October 19-20.

Society of Exploration Geophysicists, Ambassador Hotel, Los Angeles, October 19-20.

Permian Basin Oil Show, Odessa, Tex., October 19-22.

Independent Natural Gas Association of America, annual meeting, Shamrock Hotel, Houston, October 23.

National Lubricating Grease Institute, annual meeting, Edgewater Beach Hotel, Chicago, October 30-November 1.

November

Mid-Continent Oil and Gas Association, Louisiana-Arkansas Division, annual meeting, Roosevelt Hotel, New Orleans, November 2-3.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Washington 25, D. C. Notice is hereby given that the NW¼NW¼ sec. 23, T. 20 S., R. 28 E., N.M.P.M., New Mexico, within the known geologic structure of the Russell field, will be offered for oil and gas leasing, through competitive bidding, at 1 p.m. Eastern Standard Time, September 6, 1950, when bids will be opened. The details of the lease offering and how and where to file bids may be obtained by addressing an inquiry to the Manager of the Land and Survey Office, Santa Fe, New Mexico, or to this office. Marion Clawson, Director.

LEGAL

UNITED STATES DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Washington 25, D. C. Notice is hereby given that the NE¼SE¼ sec. 20, T. 24 N., R. 1 W., M.M., Michigan, 40 acres within the known geologic structure of the St. Helens field, undefined, (also known as Richfield field), will be offered for oil and gas leasing through competitvie bidding at 1 p.m., Eastern Standard Time, September 6, 1950, when bids will be opened. Details of the lease offering and how and where to file bids may be obtained by addressing an inquiry to this office. Marion Clawson, Director.

LEGAL

UNITED STATES DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Washington 25, D. C. Notice is hereby given that the NE¼ sec. 22, T. 27 S., R. 23 E., M.D.M., California, 160 acres within the known geologic structure of the Semitropic field (undefined), will be offered for oil and gas leasing through competitive bidding at 1 p.m., Eastern Standard Time September 6, 1950, when bids will be opened. Details of the lease offering, how and where to file bids and a description of the lands may be obtained by addressing an inquiry to the Manager of the Sacramento Land Office, or to this office. Marion Clawson, Director.

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Permian Basin

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WEST TEXAS (DISTRICTS 8 AND 7-C) WILDCAT FAILURES

Cottle County: Harold H. Hamilton 1 T. J. Richards est., T. Flint Sur., A-362, 9 mi. S Paducah, dry, TD 6,005 ft., elev. 1,834 ft., Cisco reef 4,246 ft., sand 4,291 ft.

Crockett County: Hudson-Stanfield 1 University, 35-29-University Lands, 3 mi. E. Lancaster Hills field, dry, TD 1,860 ft. Humble Oil & Refining Co. 1-C Alma Cox, 72-OP-GC&SF, 13 mi. W Magnolia 1 Clayton discovery, 1 mi. N Humble 1 Alma Cox failure; dry, TD 8,678 ft., elev. 2,532 ft., Wolfcamp 5,330 ft., Ellenburger 8,128 ft.

Garza County: O'Neal Drilling Co. 1-A P. G. Spining, 15-5-GH&H, 7½ mi. SE Post, dry, TD 3,150 ft.

Kent County: Sun Oil Co. 1-A Bilby Wallace, near SW SW 21-98-H&TC, 1½ mi. NE of Strawn production, dry, TD 7,315 ft., elev. 2,093 ft., Ellenburger 7,273 ft.

Pecos County: Basin Oil Corp. 1 H. E. Bonebrake, 4-10-H&GN, dry, TD 1,420 ft.

Scurry County: Superior Oil Co. 10 G. H. Morley, 600-97-H&TC, in NW corner of county, 2 mi. NE Superior-Intex 1 Jordan, Mississippian discovery; dry, TD 8,467 ft., elev. 2,823 ft., San Andres 2,300 ft., black shale 6,030 ft., reef 7,860 ft., Mississippian 8,280 ft., Ellenburger 9,430 ft.

Tom Green County: York & Harper 1 Ike Funk, 30-5-H&TC, 2 mi. E Funk field, dry, TD 1,285 ft., elev. 2,305 ft., San Andres 1,070 ft., Glorietta 1,139 ft., Clear Fork 1,204 ft.

SOUTHEAST NEW MEXICO

HOBBS.—Gulf Oil Corp. 1 Sams-State, 17-15s-33e, Lea County wildcat, was drilling in lime and shale at 12,838 ft., after the installation of heavier rig.

Wilson Oil Co. 1 Charlotte-State, 5-21s-34e, was drilling below 3,925 ft. Location is 2½ miles northwest of production in West Wilson field.

Stanolind's 3 South Mattix Unit, NW NE 22-24s-37e, in the two-well Fowler Ellenburger field of southeastern Lea County, recovered 3,000 ft. of clean oil and 1,500 ft. of heavily oil and gas-cut mud, with no water, on a 4-hour drill-stem test from 7,478-7,530 ft. Open flowing bottom-hole pressure was 1,100 psi. Operators were drilling ahead.

Nearest Silurian production is in Dollarhide field of Andrews County, Texas, some 12 miles to the southeast.

Location is one-half mile south of Stanolind's 1 South Mattix Unit, discovery of the Fowler field, and a southeast offset to the 2 South Mattix unit which also produces from the Ellenburger. Neither of the wells had oil shows in the Silurian.

SOUTHEAST NEW MEXICO WILDCAT FAILURE

Lea County: Culbertson & Irwin 1 Gilmore, SW NW 21-22s-32e, dry, TD 4,846 ft., elev. 3,666 ft., anhydrite 852 ft., salt 986-4,356 ft., Delaware sand 4,666 ft.

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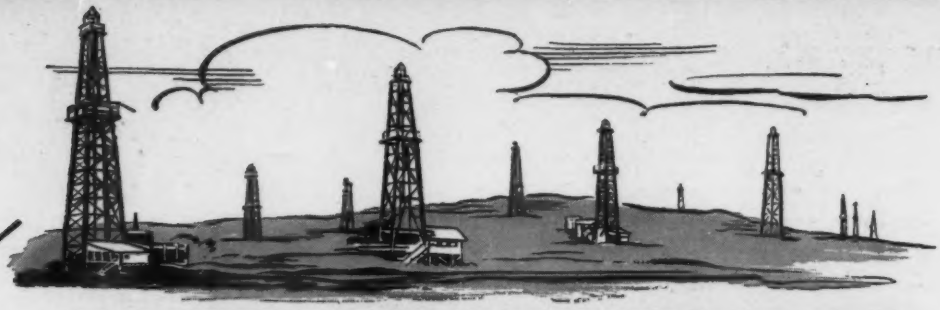

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